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VOL. 71. NO. 7

A. PRESCOTT FOLWELL, Editor

W. A. HARDENBERGH, Asso. Editor

Timewasters

Mr. Bevan's wine article apparently fell among a lot of dry folks, for the response was not very heavy. Mr. Blunk says 3.33 gallons, but Mr. Bevan does not agree with this and says that the answer is 3.72 gals. We are neutral and don't care who gets that extra 0.39 gallon. Here are two gentlemen for whom we have a very high regard and we don't know which to believe. What is the verdict of our readers? See the June issue, page 7.

A Stack of Boards:

Another by Mr. Bevan. A stack of boards, consisting of oak, pine and birch, measures 2,160 feet when the boards are placed end to end. The average length of all boards is 19 7/11 ft.; of oak boards and pine boards 19½ ft.; of pine boards and birch boards, 22 2/13 ft.; of oak boards and birch boards, 17 3/5 ft. If each oak board had been 1 ft., each pine board 3 ft., and each birch board 6 ft. longer, their total average length would have been greater by 3 ft. How many boards of each kind were there and what were their average lengths?

Off to Camp:

At this time of the year, your humble timewaster normally gets away to army camp for a brief period. This year he is assigned to do some work in Washington. Here's hoping that we don't have that usual Washington weather during July. And to all other reserve officers who go to camp, our regards. . . . WAH.

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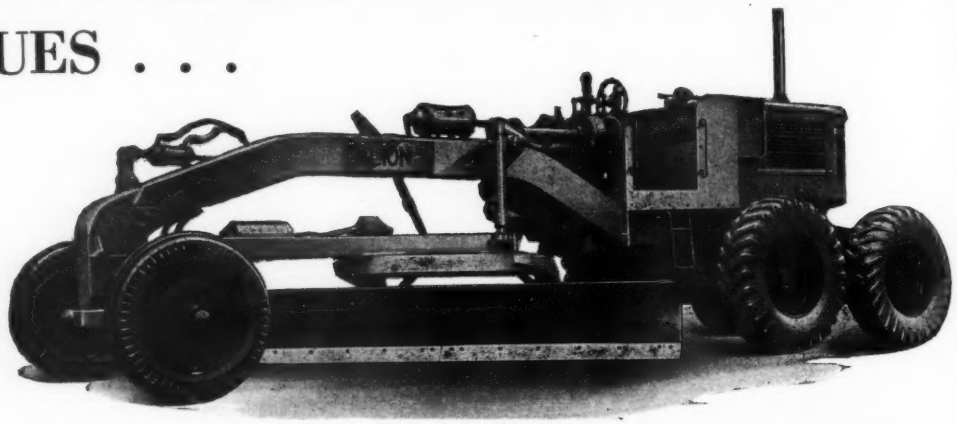

The No. 201 motor grader for moderate blading in road construction and maintenance is shown above. Next below is shown the big No. 101 motor grader in bank-cutting position. Both units have a wide range of blade adjustment for any condition.

No. 101 Motor Grader—a big sturdy unit for the toughest kind of blading work in new road building and maintenance. Equipped with either a 66½ HP diesel or 64 HP gasoline engine and tandem drive only. Has many features for low-cost performance day after day.

Bulletin No. 253

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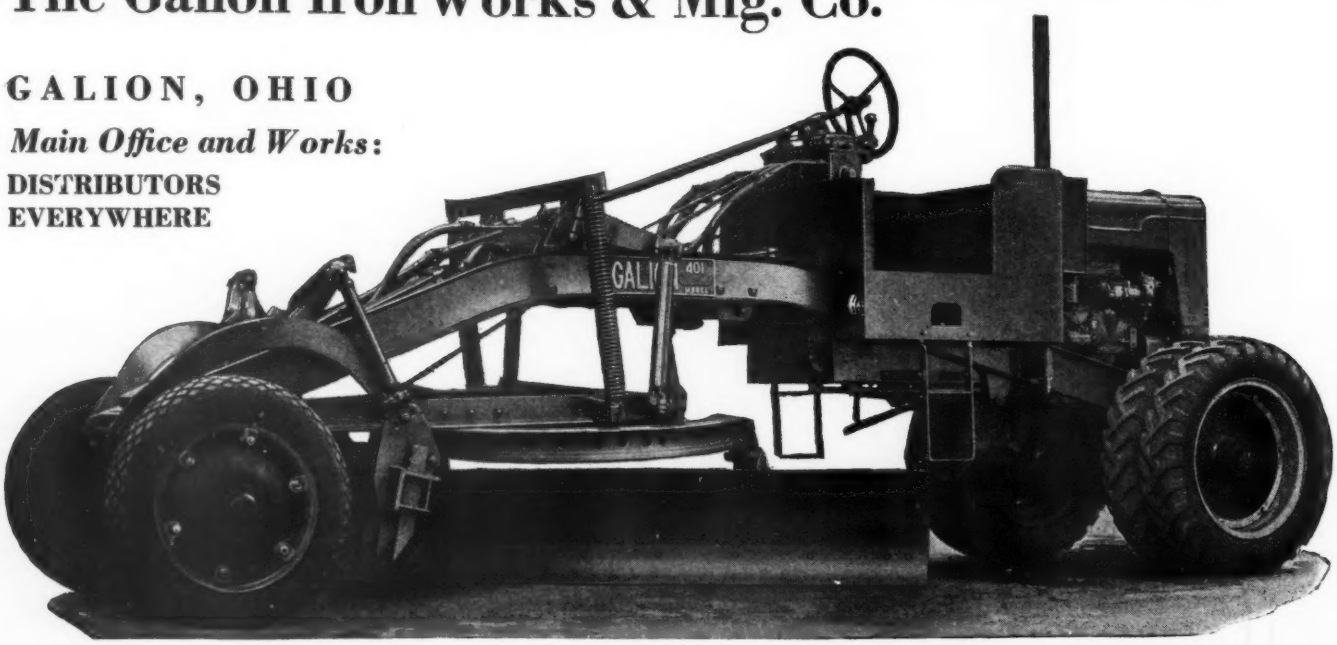

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 63-65

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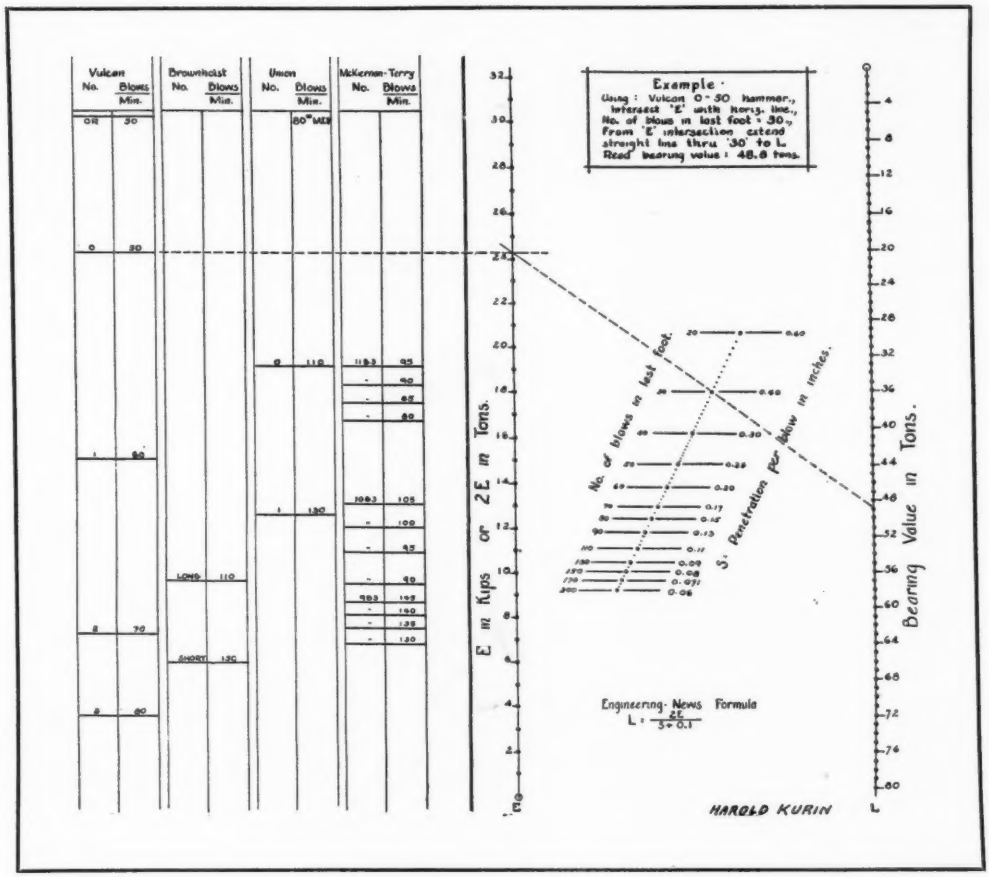


Normagraph to Show Bearing Power of Pile Driven by Standard Hammer

By HAROLD KURIN

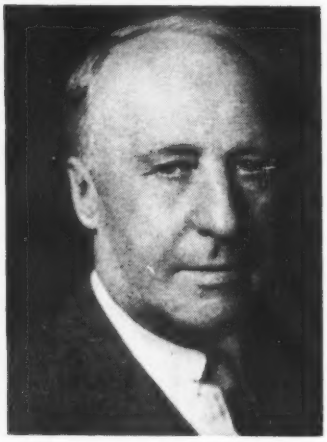
I WAS employed recently as a pile-driving inspector on a bridge substructure contract. There were 2,000 piles to be driven, of which 1,200 were untreated timber piles approximately 32 feet in length each and 800 were creosoted timber piles having an average length of 45 feet each. These piles were to be driven to a definite tip elevation.

The soil encountered as shown by test borings was a fine beach sand with a slight percentage of clay. The hammers used in driving were McKiernan-Terry 9B 3 and 10B 3.

The daily report to be turned in to the field office listed the pay length of pile, blows per foot, speed of hammer and the computed bearing value of the pile based on the Engineering News Formula.

An average of thirty piles was driven per day. In making up the report it was found that it took quite some time to reduce the Engineering News Formula for thirty piles. After some study I made up a normograph and set it up so that it could be used with almost any standard hammer.

The normagraph is self explanatory and I believe it will assist any one who finds it necessary to determine the bearing value of piles using the Engineering News Formula. I have found that values can be taken off to the nearest tenth of a ton.



Lester C. Hammond

Solving Difficult Location

By LESTER C. HAMMOND

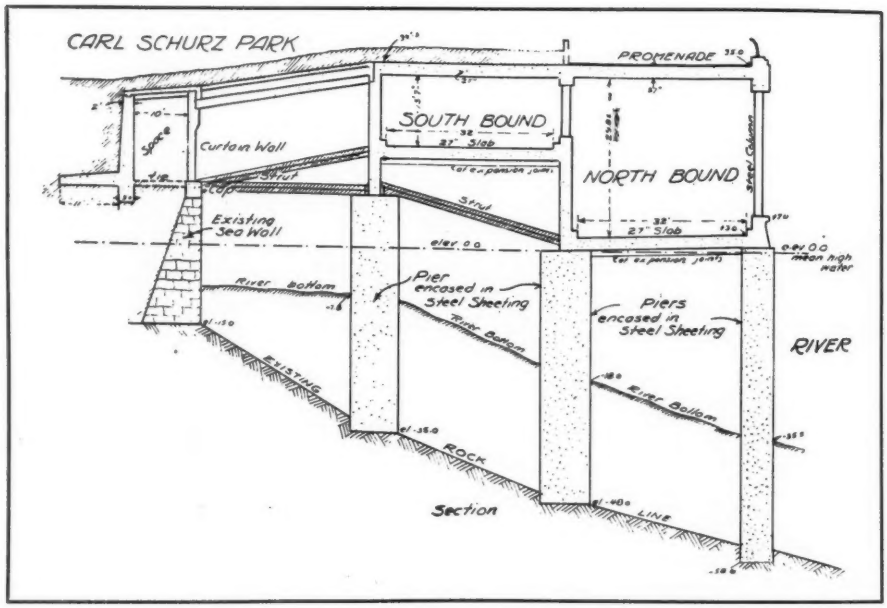
Chief Engineer, Department of Borough Works
Borough of Manhattan, New York City

THE East River Drive, a portion of the circumferential system of highways around the Island of Manhattan in the City of New York, is a six-lane divided highway situated along the shore of the East River.

The sections of the drive which have been completed and opened to traffic extend from Montgomery Street to 23rd Street at the southerly end, and from 92nd Street to the Triborough Bridge and 125th Street at the north. The construction of these sections consisted of concrete relieving platform bulkhead walls behind which new land was made by backfill. Upon this made land were laid out the two roadways, each 33 feet in width, divided by a center mall. The pavement used is sheet asphalt, in general landscaped on the offshore side.

One section of drive, 2 1/3 miles long, between 49th Street and 92nd Street was officially opened June 18th. In this area, some of the most difficult situations were encountered because of several skycraper apartments fronting upon the river, only about 40 ft. inshore from the U. S. Bulkhead line. The problem here was the placing of a highway normally one hundred feet in width into a forty-foot right of way. The solution was reached by double-decking the highway, carrying the southbound roadway over the northbound roadway.

This treatment was utilized at two locations, namely, between 55th Street and 62nd Street, and between 79th Street and 90th Street. In general, the structure used in these cases was of reinforced concrete design. From 55th Street to 60th Street the lower roadway is constructed upon bed rock on a side hill cut; from 60th Street to 62nd Street upon steel piles driven to rock through fill placed behind the new relieving platform bulkhead wall. The upper roadway is supported by double columns 45 ft. on centers on the offshore side, and by retaining walls on the inshore side. Continuous reinforced concrete girders 6 feet in depth and 2 ft. 6 ins. wide span three bays on piers spaced 45 ft. on centers or 135 feet between expansion joints. The roadway slabs are 27 inches in depth and also run continuously over three bays between expansion joints.



Cross-section of drive, between 79th and 90th Streets

The concrete used was of a 1 : 1 2/3 : 3 1/3 mix, using Long Island sand as fine, and Long Island commercial ¾-inch gravel as coarse aggregates. The cement used was a sulphate resistant cement having a maximum computed tri-calcium aluminate content of 7 per cent. The water-cement ratio varied between 4.0 and 5.0 gallons per bag of cement, giving a slump varying between 2 and 4 inches. The concrete was poured continuously in sections 135 feet in length between expansion joints. The girders, slabs, and steel beam coverings were poured monolithic. Each pour required about 500 cubic yards of concrete.

The upper surface of the slab was finished by screeding, darbying, and brooming to furnish the roadway surface. Each roadway was divided into three traffic lanes, 10, 11, and 11 feet in width respectively, by dummy longitudinal joints inset with special raised aluminum traffic markers placed on fifteen foot centers.

The section between 79th Street and 90th Street is very similar in structural design to the section between 55th and 62nd Street. It differs mainly in the type of foundations, the utilization of the roof as a landscaped promenade, and a tunnel extension.

In this section the foundations are, in general, elliptical shells 6 feet by 4 feet or circular shells 9 ft. in diameter, constructed by driving interlocking sheet piling to rock. Upon completion of the caisson shell, the interior was excavated by orange peel buckets, rock foundation levelled up and then filled with tremie concrete. The caissons varied from 20 to 60 feet in depth below high water.

The roof of the upper roadway extending from 81st Street to 88th Street, forms a 2-acre extension of the adja-

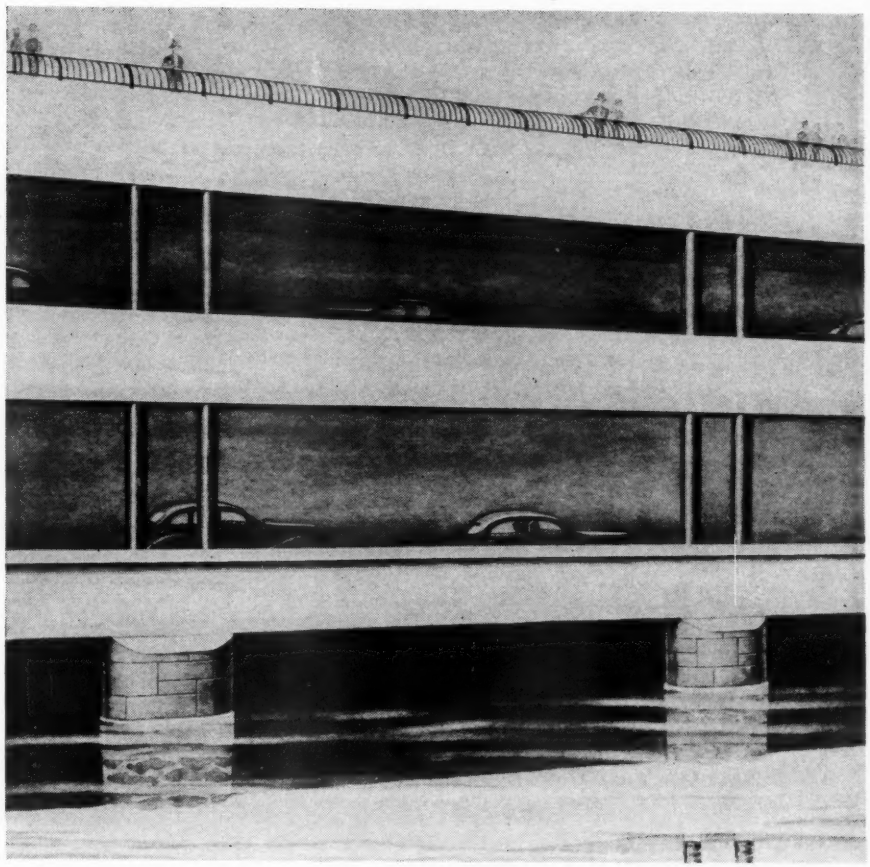
Problems in New York City's East River Drive

This six-lane divided highway, part of a system which ultimately will traverse the entire water front of Manhattan Island, solves complicated location problems by being in succession a surface road, an elevated structure, a tunnel and (where right-of-way was restricted) divided into two decks, one above the other.

cent Carl Schurz Park, and serves as a landscaped riverfront promenade.

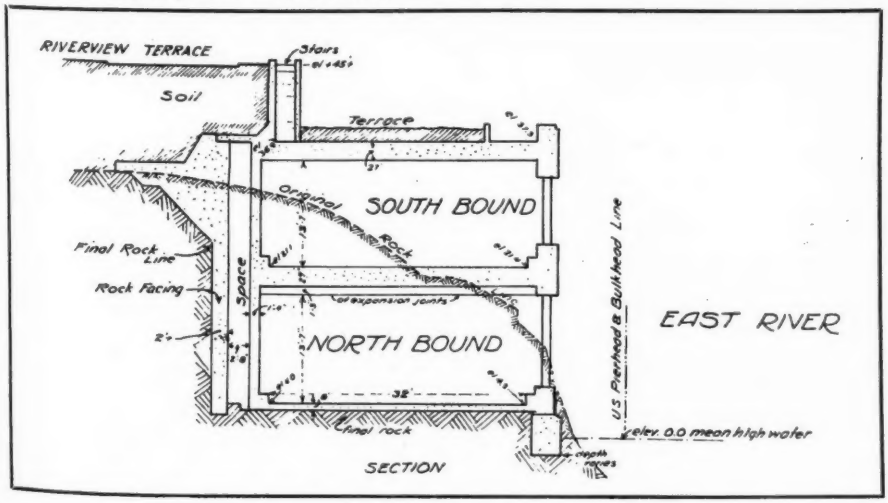
From 88th Street, where the two roadways return to the same grade, they pass into a tunnel to 90th Street. This tunnel passes under the lawn of the Gracie Mansion, built during the Revolutionary War, and thereby preserves the original vista. From 90th to 92nd Street where it connects with the existing roadway, the drive is composed of two 33-ft. lanes at grade. On this portion of the drive, extending from 49th Street to 93rd Street, a distance of 2 1/3 miles, 16 contractors were employed. The lower viaduct section from 54th Street to 62nd Street was constructed by Poirier & McLane at a bid price of $1,500,000. The upper viaduct section between 79th Street and 90th Street was built by J. Rich Steers at a bid price of $2,400,000. The other contracts were for bulkhead construction, roadway, paving, landscaping, and the construction of overpasses, and other appertaining structures. The bid prices totalled $8,500,000 in this area.

The link from 23rd to 30th Street is practically completed except for the paving. The closing link between 30th Street and 49th Street will be let this summer and completed in 1941. At some future date when traffic warrants, the drive will be extended as an elevated structure to the Battery where it will connect with the West Side Elevated Express Highway and the Battery-Brooklyn Tunnel.



Double-deck section viewed from river.

Double-deck highway north of 58th Street.



The work was designed and directed by the Department of Borough Works, Borough of Manhattan, City of New York; Stanley M. Isaacs, President Borough of Manhattan, Walter D. Binger, Commissioner, Lester C. Hammon, Chief Engineer, J. C. Collyer, Engineer of Design, and Pincus Rizack, Engineer of Construction.

New Filter Plant Replaces Old at Thomaston, Ga.

City water plant, Thomaston.

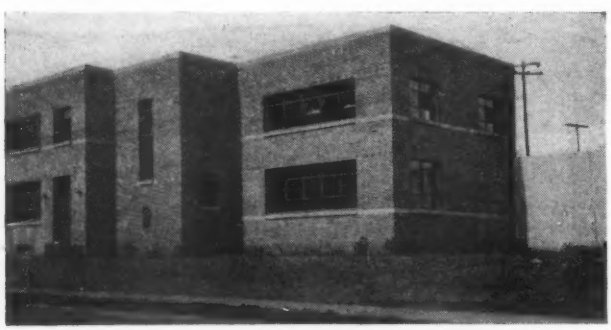
REPLACING an antiquated plant, the City of Thomaston, Ga., (population 4,992) has constructed a new water filtration plant with a capacity of 1.5 mgd. The new plant, which was designed by Robert & Co., consulting engineers of Atlanta, Ga., includes also some new features and additions, supplementing the old plant.

The raw water is drawn from Potato Creek through a 12-inch cast iron line to the mixing chamber. At the head of the mixing chamber is a pre-mix unit, which is of the over-and-under baffle type. This has several functions, among which are: It assures a proper initial mixture of the chemicals and the water under all conditions. If both of the mixing-channels are in operation, it assures that the water entering each receives the proper chemical treatment. And it likewise assures a proper initial mix in case either of the channels is out of operation for any purpose.

Further mixing of the chemicals is by means of two over-and-under baffled channels, constructed of 2-inch cypress baffles placed 6 inches apart for the first 15 feet; 8 inches apart for the next 15 ft. 8 ins., and 14 ins. apart for the next 18 ft. 4 ins. This arrangement provides an initial more violent mix, followed by a less violent agitation during the initial floc-forming period.

In the pre-mix chamber are added alum, lime, activated carbon and ammonia-chlorine. Omega dry feeders are used and an extra feeder is provided for post lime treatment. Chlorination and ammoniation are by Wallace & Tiernan equipment and an extra chlorinator is provided for post-chlorination in case a residual from the pre-treatment cannot be carried through the plant.

From the mixing channels, the water passes into a distributor flume 2 feet wide and 2 feet deep and thence into a stilling channel through streamlined openings fitted with aluminum gates. These openings and gates, by the elimination of angles and corners, reduce or eliminate vortices and eddies, which tend to break up the floc particles.



Front view of city water plant—1940.

From the stilling channel, the coagulated water passes through tapered and beveled holes to the settling basins. This construction also is designed to prevent breaking up or dispersion of the floc. The holes are tapered outward with the flow from 4 inches to 6 inches and edges are beveled and smoothed so as to produce the least possible disturbance in the flow of the water. These holes are placed across the end of each basin in four horizontal rows, staggered vertically, extending nearly to the bottom, and with the holes spaced about 30 inches on centers. There are 44 such holes in the end of each basin. Provision is made so that, if desired, some of the holes can be closed.

The two settling basins are each 31 feet 0 ins. wide, 55 ft. 4 ins. long and 14 feet deep. The floor of each basin is sloped to a central channel built into the floor, through which sediment can be removed conveniently by flushing. The settling basins provide the detention period, usual in Georgia, of 6 hours.

The takeoff from the settling basins is by an overflow flume and thence to the filters, of which there are three, each 14 feet by 12 ft. 6 inches. At the usual rate of 2 gals. per sq. ft. per minute, each has a capacity of 500,000 gallons per day. Each filter is provided with two cast iron wash water troughs, 7′ 0″ on centers, which discharge into a forebay, and thence to the sewer. The under-drainage system is composed of 2-inch laterals 6 inches on centers. Each filter is provided with an International rate controller. Filter wash water is provided by a 30,000 gallon elevated tank.

From the filters, the filtered water flows by gravity to the clear wells, of which there are two: one is rectangular with a capacity of 250,000 gallons; the other circular with 100,000 gallons capacity. Both are of reinforced concrete, and are covered. From the clear wells the water is pumped to the distribution system and to elevated storage.

Incoming raw water to the treatment plant is regulated by a venturi meter and control.

The plant was completed during the summer of 1939. At present it is being operated at about 350,000 gallons per day—that is, for 6 or 8 hours each day, which is sufficient to meet present needs.

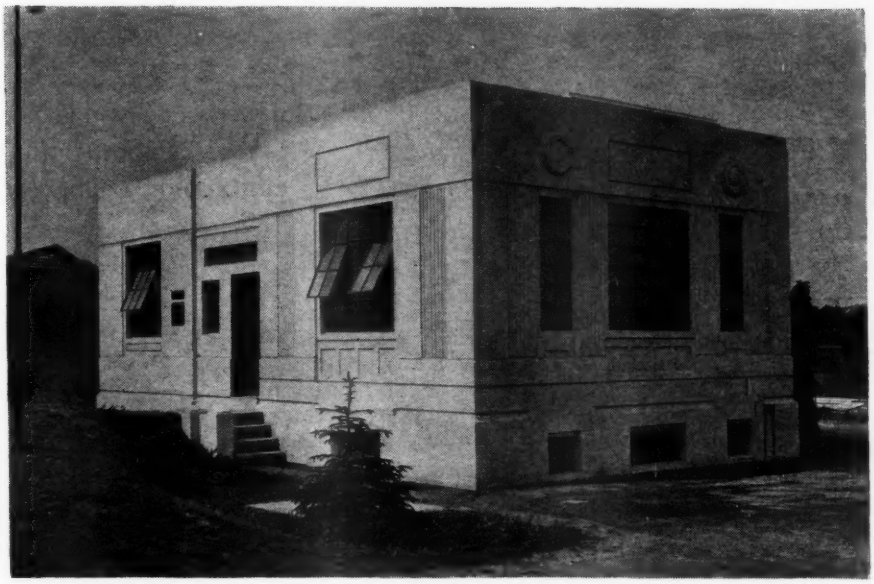
Typical analyses of raw and filtered water are:

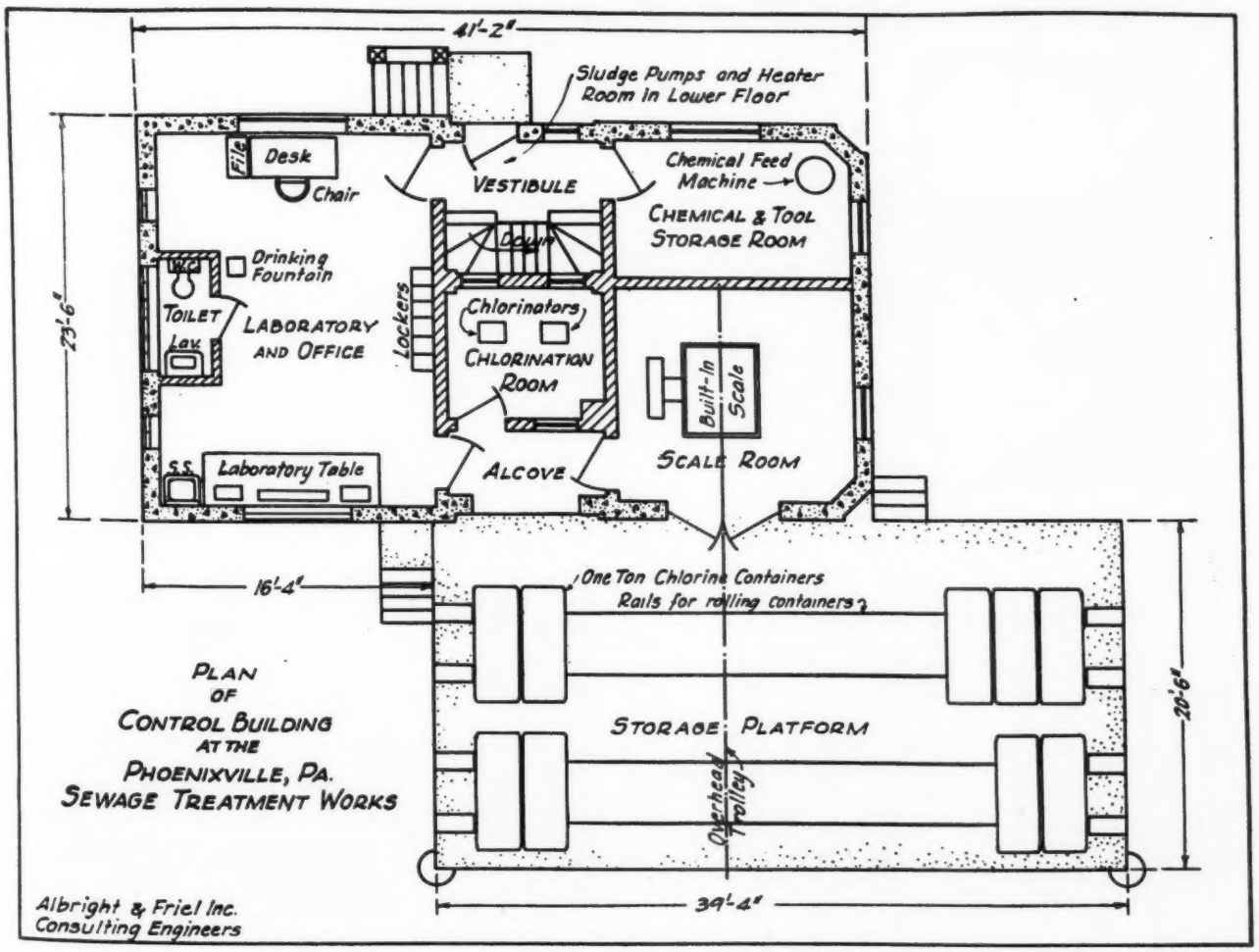
	Raw Water	*Filtered Water*
Alkalinity	20 ppm	20 ppm
Turbidity	25 ppm and up	0
CO_2	2 to 3 ppm	5 to 6 ppm
pH	6.9 to 7.1	8.0 to 8.2

The general contractor for the plant was Smith & Pew Construction Co., Atlanta, Ga. The filter equipment was furnished by Hornbuckle & Cole., Atlanta. Ga. H. K. Thurston is mayor. The Supt. of Water Works is J. M. George.

Attractive Control Building For the Sewage Treatment Works at Phoenixville, Pa.

At the right is a view, and below is shown the floor plan, of the very attractive building which houses the sewage treatment plant of Phoenixville, Pa. This was built in 1939 with a PWA grant. Albright and Friel, Philadelphia, were the engineers. Thomas Procter, Philadelphia, was the contractor.





Efficient Organization and Good Feature Jefferson County

Organization and planning for efficient and economical construction and maintenance of 1500 miles of county roads in 1200 square miles of mountainous area containing a population of 500,000.

JEFFERSON County, Ala., has an area of about 1200 square miles, most of which is mountainous and broken country; there are some 1500 miles of adopted roads; the population of the county aggregates about 500,000, 75% of whom are in the Birmingham metropolitan area in the central part of the county. Surrounding the cities of Birmingham and Bessemer are many built-up unincorporated areas where a high type of road surface must be provided.

Rich in minerals, this is a one-industry area. Steel is proverbially either prince or pauper, and this does not make for stability in planning and in carrying out

The central garage, a few miles out of Birmingham.

long-range programs. Yet, in an area so large with so many problems to be solved, organization and planning are essential. This article is intended to emphasize these phases of the work in Jefferson County, because the principles that have been applied there with such excellent results can be adapted to many conditions.

General Organization and Personnel

Jefferson County is governed by a 3-man elective commission; the election is county-wide, and after election the commissioners are assigned departments, these being finance; public improvements; and welfare. The county engineer is assigned all engineering functions. In general, these may be grouped under three heads: Highways; sewers; and county equipment. The county engineering organization, which is entirely under civil service, consists of a chief engineer, a highway engineer, an assistant highway engineer (who acts as construction engineer), a maintenance superintendent, a right-of-way engineer, a sanitary engineer, a mechanical superintendent and a chief clerk. All of these men have been with the county for at least twelve years, and four of them are corporate members of the American Society of Civil Engineers.

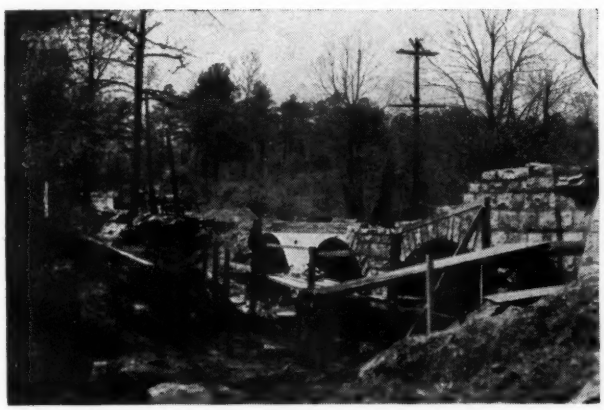
The personnel responsible for handling this work consists of the following: The members of the County Commission are R. H. Wharton, president and Commissioner of Finance; Henry W. Sweet, associate member, in charge of Public Welfare; Earl Bruner, associate member in charge of Public Improvements and directly in charge of the work described in this article. Harry H. Hendon, county engineer (formerly sanitary engineer); D. A. Helmich, Highway Engineer; M. E. Boriss, Sanitary Engineer; E. H. Gilmore, Maintenance Engineer; C. J. Rogers, Assistant Highway Engineer in charge of construction; T. C. Manning, Right-of-Way Engineer; C. H. Hamilton, Mechanical Superintendent; and C. R. Hicks, Chief Clerk and Accountant.

Much of the work at present is being done in cooperation with the WPA. Last year about $3,000,000 was expended on highway construction, 4,000 men being kept at work. The program this year will be reduced, and about 1,000 men will be employed on WPA, with an estimated expenditure of about $1,000,000. In this connection, while 23% of the gas tax of the State of Alabama is collected in Jefferson County, the share allocated to the county amounts to only about $100,000, and the county actually pays into the state $18,000 tax on the gasoline used on county business. Of the total gas tax, one-half goes to the state and the

The county's streamlined gas delivery truck.

Management Highway Work

Left to right: D. A. Helmich, Hwy. Engr., Earl Bruner, Assoc. Member County Comm., C. H. Hamilton, Mechanical Supvr., Harry Henden, County Engineer.



Triple arch span being built on Shades Mountain road.

remainder is divided equally among the 67 counties in the state.

Duties and Outline of Work

The first duty of the highway engineer is planning. So far as is possible, plans are made at least a year in advance. Four survey parties are kept in the field. The principal problems in planning are concerned with the formulation of a comprehensive plan for serving the Birmingham metropolitan district, providing entrances for the principal state highways and constructng a belt or circumferential highway around the city. This will be a 4-lane divided highway.

The principal duty of the assistant highway engineer is construction. He receives the approved plans and specifications and carries out the work. All highway work is being done by WPA and county forces. The principal type of paving placed by the county is double surface treatment, using tar and slag, both of which are produced locally. Some stabilization has been placed, using salt.

In the eastern half of the county, there is an abundance of excellent chert surfacing material and chert roads are built; in the western half shale and sandstone predominate, so most of the rural roads are of earth. The county owns considerable construction equipment, which is furnished for WPA work, and the county also provides the material. A soil laboratory is maintained, with a full-time chemist and two soil inspectors. Beginning this summer, one of these inspectors will be assigned to the maintenance division and surfacing will be carried on under laboratory control.

The right-of-way engineer's duties are obvious. The work is especially difficult because of the built-up areas and the special problems of the State Highway Department in obtaining suitable entrances into the city. The county furnishes all right-of-way for the State and costs for this approximate 40% of the highway budget. Special attention has been given to providing for this in advance. Whereas last year there were cases where construction had to wait for right-of-way, it is hoped to acquire this year right-of-way for next year.

Sanitary engineering involves design, construction and maintenance of all trunk sewers and the operation of four treatment plants. Jefferson county is a sanitary district and as such maintains trunk sewers into which the principal cities and the heavily populated areas outside of them discharge their sewage. It is a function of the county engineer's department to design, construct and operate the necessary sewage treatment plants. Many of our readers will recall one of these, the Shades Valley sewage treatment plant, which was designed and constructed a few years ago by Mr. Hendon, then Sanitary, now County, Engineer.

Accounting is handled by the chief clerk, a member of the county engineer's staff. He is responsible for keeping all cost records. Work of all kinds is done on cost tickets, which are turned in to the accounting department properly filled in to show the time, material and equipment chargeable to each piece of work. County equipment is "rented" for each job, the rental rates being so fixed as to cover all costs in connection with them. All county roads are numbered, and charges are carried against each for maintenance as well as for construction. Labor, equipment and materials are charged against such items as clearing, right-of-way, drainage structures, surface, surfacing, resurfacing, etc. This general procedure covers and is used on highways, sewers and sewage treatment and automobiles. Semi-annual reports are made on each piece of equipment showing the work done by it and the cost of operation. A monthly statement is made on each numbered highway.

One of the duties of this division is to purchase gasooline and oil and furnish these to all county automobiles; also to maintain the automobiles for all county departments. This will be discussed in connection with the mechanical division, which will be covered later.

Maintenance and Equipment Data

Under the maintenance superintendent is placed all of the work in connection with the upkeep of highways. Until two years ago, all misdemeanant prisoners—short time prisoners—were employed on the county highways. These averaged 500 to 600, many of whom were not capable of work on highways, but their entire cost was charged to roads and bridges, these charges including food, medical care, guards, etc. They were maintained in 7 to 10 camps throughout the county. Prisoners are now turned over to the state convict system and the county leases from the state about 150 able-to-work negro men. The state feeds, clothes and maintains them, checking them out to the county in the morning and receiving them back in the evening, for which the county pays $25 per month per man. They form an excellent source of labor and are now housed by the state in two camps in the county, conveniently located in the two maintenance districts. These men do not operate equipment.

Experience, especially over the past two years, has demonstrated the greater utility of rubber-tired motor patrols and maintenance units. The county has recently purchased its first portable crusher and results have been most satisfactory; more of them will be purchased next year. There are now 6 power shovels in use, one 1-yd., two ¾-yd. and three ⅜-yd. Two of these were purchased this spring.

Operators of all equipment are on straight salary, under civil service, with two weeks sick leave and two weeks vacation with pay. They wear a uniform consisting of a khaki shirt, khaki trousers and cap. The working week is 45 hours—five 9-hour days; there is no work on Saturday morning because too much travel is usually involved in getting to and from the site of the work. All equipment is washed, inspected and greased on Saturday morning at the district maintenance camps by men from the Mechanical Department.

Work is now being started on placing directional and warning signs on the county roads. Recognized standard markings will be used. The signs are being made in the county shops.

The County's Bridge Problems

On the 1500 miles of county roads, there are an estimated 4,000 small wooden culverts and bridges. None of this type has been built for more than a year; instead, pipe or concrete culverts are being used for replacement. There are also a large number of steel bridges in the county. On 80 of these, which are short-span bridges in satisfactory condition, treated wooden floors have been placed. The treatment process is by osmose salt and the work is done by county forces, using convict labor.

There are 87 large steel bridges in the county. A recent survey of these bridges, which are from 12 to 60 years old, showed that only two could be considered as modern in all respects. Accordingly a replacement and improvement program has been worked out, as follows:

Four large river bridges, 300-ft. span and over, are to be replaced with Federal Aid money, by contract, one each year for the next four years. An aerial survey has just been made of one of these bridges which is located in the wild country along the Warrior river.

Seven other large bridges will be strengthened, repaired and continued in service.

Twelve bridges are located on roads that are no longer necessary because of new roads or for other reasons, and will be abandoned and the roads to them will be closed.

Forty-two bridges on minor roads will be tightened, painted, refloored and left in service.

Twenty-two bridges will be replaced by suitable concrete structures before June, 1941, using WPA labor for construction.

The Mechanical Department

The county operates 210 pieces of motor equipment, including automobiles. To care for these, there is a central repair shop a few miles out of Birmingham at which all repair work is done, including body repairs, upholstery and mechanical. All equipment is painted annually with a distinctive bright yellow color. Each piece is numbered and a separate cost record is kept on each. A central repair shop is maintained at one of the camps.

Gasoline is bought monthly, 4 to 6 car loads at a time, and stored in elevated tanks for distribution by the county's own tank truck to four stations operated by the county. Oil and diesel fuel are purchased in 55-gallon drums, by the carload. Oil filters are standard on all county equipment and their use has resulted in a very large saving in oil consumption. Diesel powered equipment is used wherever practical, due to the saving in operating cost. A tax of 6 cents a gallon is paid on all gasoline used by the county—about $18,000 annually.

Gas is sold to other departments of the county at cost plus 2 cents a gallon to care for the costs incident to operating the gas stations. There is a downtown filling station near the courthouse for official cars. A second filling station is maintained at Bessemer, near the court house (Jefferson county has two courthouses), and a third in the southern portion of the county near the maintenance camp serving that area.

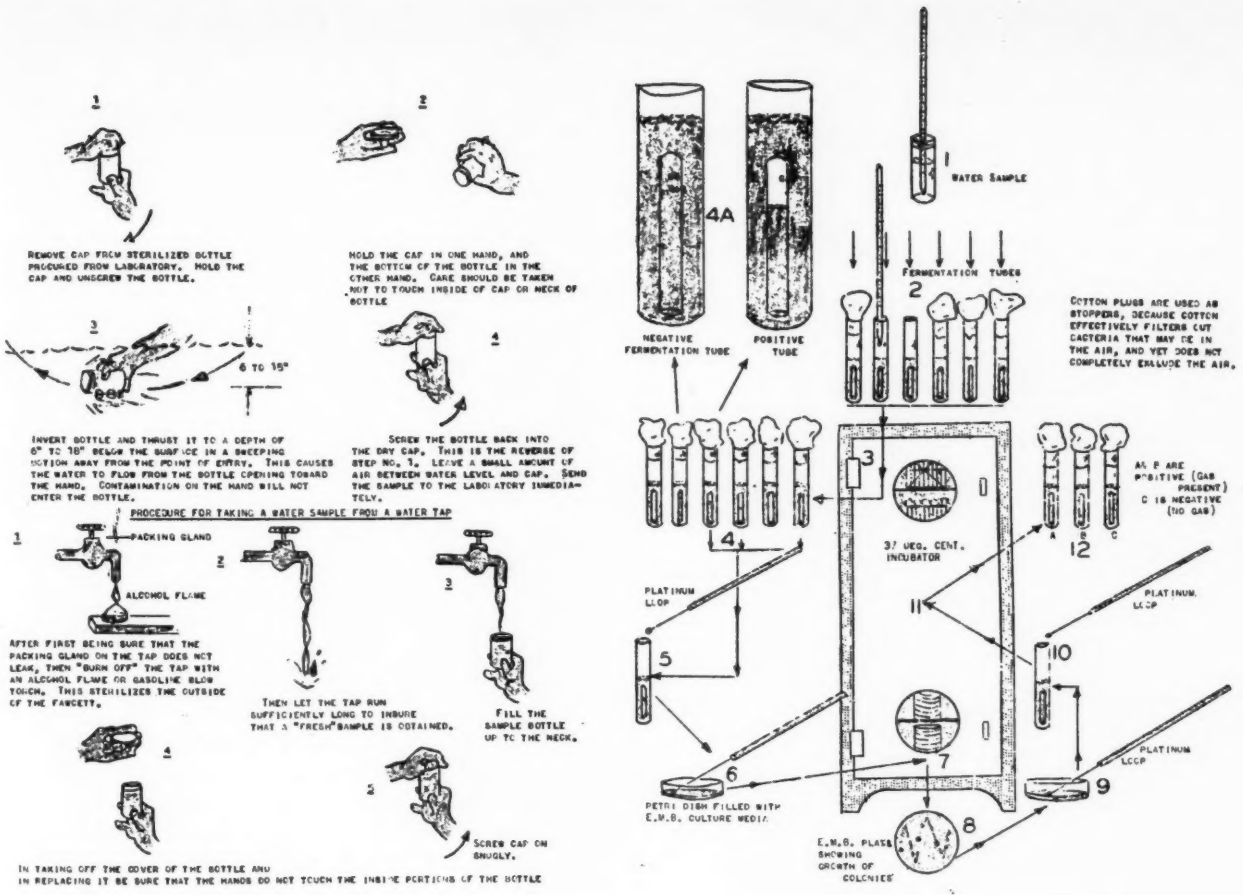
This centralization of work has resulted in large savings. By careful maintenance of the equipment, "recapping" of tires (a form of retreading) and control of equipment through a knowledge of operating costs, plus centralized purchasing and revision of convict labor use, overhead and operating costs have been greatly reduced. It is estimated that the savings accomplished by the changes in the convict labor system alone will pay for the bridge replacement program.

Other Functions; Operating Costs of Equipment

One of the minor functions of the county engineering department is to operate a central laundry, serving all county institutions, including three hospitals. This handles about 120,000 pounds of laundry per month and makes a profit on operation by charging 3 cents per pound. The work is done in a well equipped laundry located at the maintenance shop; the work being done by convicts hired from the state.

Records indicate the ecenomy of diesel powered motor graders. The seven diesel units owned by the county were operated 26,700 miles at a total cost per mile of 22 cents; the 15 gasoline driven units were operated 43,100 miles at a total cost of 41.5 cents a mile. Moreover, the diesel driven units will do approximately twice as much work per mile of travel as the older and smaller gasoline units. These costs do not include depreciation.

Automobile operating cost records (again not including depreciation) show a steady increase in operating cost as the equipment ages. Whereas the average on automobiles one year old was only 1.89 cents a mile, it was 3.38 cents a mile on units five and six years old.



Let's Take a Water Sample

F. C. ROBERTS, Jr.

State Sanitary Engineer of Arizona

MANY requests have been received asking that we explain what occurs when a water sample is submitted to the laboratory for analysis. In order to clear up this "mystery," an attempt is made to show by diagrams and explanation how the water is "worked over" by the laboratories.

First of all, it is most important that the water sample be collected properly. The bacterial analysis of a water sample is a delicate test. If the person procuring the sample is careless, the sample will show contamination, and thus untrue results. From the sketches shown herewith, it is demonstrated that there is a correct way in which to take a sample from a stream or lake. The flow of water should be away from the mouth of the bottle and over the hand of the person taking the sample.

In procuring a sample from a tap or water faucet, the tap should be "flamed" with an alcohol flame or gasoline torch. Alcohol is to be preferred, because it does not soot up the tap. After thoroughly flaming the faucet, let the water run long enough to get a fresh sample from the water main. Take the sample in such a way that dust, the hands, or water drippings from the handle of the tap do not enter the sample bottle. The sample of water that is sent to the laboratory should be as representative of the water supply as is possible.

After the sample is received by the laboratory, it receives the following treatment, which may be followed by referring to the chart that is given herewith:

(1) After flaming the cap and throat of the bottle, the sample is opened, and 1 cubic centimeter of the water is removed and put into a fermentation tube. Then 10 cubic centimeters of water are removed and put into a second fermentation tube, 10 ccs into the third, 10 more in the fourth, 10 in the fifth, and 10 in the sixth. There are 5 ten-cubic centimeter tubes and one one-cubic centimeter tube.

(2) This diagram represents the six tubes mentioned above. These tubes are filled with lactose broth. The B coli group of bacteria have the ability to ferment lactose. The small tube, which is seen on the inside of the larger one, is put in upside down, so that if there are any fermenting organisms present, the gas will be caught in the smaller tube.

(3) These fermentation tubes are put in a 37 degree (centigrade) incubator for 24 hours. If there is fermentation in all of the tubes the next step is taken. If there is no fermentation in the tubes, they are left in the incubator another 24 hours, or a total of 48

hours. If there is no fermentation then, the tubes are reported as negative or good. If the sample is negative, a report may be made at the end of 48 hours. If the sample is positive, the positive tubes must undergo the following steps.

(4) This sketch shows the six tubes as they are withdrawn from the incubator. Tubes Nos. 3, 4, and 6 show the presence of gas, so these tubes are positive.

(4a) This enlarged sketch shows a negative fermentation tube, and one that is positive. There is no question about a positive tube. The small inverted tube is usually filled with gas as a result of the fermentation process.

(5) This step applies to the positive tubes only. A platinum loop (small loop made of platinum wire) is inserted into the positive tube, and a drop of the liquid is removed in this loop. A positive tube contains millons of bacteria, so that one loop or drop of this liquid will contain many hundred or thousands of these organisms. The reason for the use of a platinum wire is that it heats readily, and cools quickly. It may be quickly sterilized over a flame, and then be quickly cooled before it becomes contaminated.

(6) This loop-full (or drop) of lactose broth is smeared on an E.M.B. plate. E.M.B. is the initials for Eosine-methylene-blue, which is a dye. The B coli group of bacteria like this culture medium, and grow luxuriantly on it. One bacterium grows and becomes a colony that can be seen with the naked eye. A b coli colony that grows on E.M.B. develops a color that is different from any other organism; it has a metallic sheen, that may be readily recognized.

(7) After the loop of broth is streaked across the E.M.B. plate it is introduced into the incubator again, so that it may grow from one bacterium to a colony of bacteria. It might be said at this point, that 37 degrees centigrade is approximately the blood temperature of humans. It is the natural or best temperature for B coli.

(8) After the E.M.B. plate has incubated for 24 or 48 hours, it is taken out of the incubator and examined. Suspicious colonies of bacteria are examined, and if the bacteriologist decides that they are positive, he

(9) Loops (scrapes) them off of the E.M.B. plate and puts them in another fermentation tube.

(10) This fermentation tube is identical to the first fermentation tubes.

(11) These fermentation tubes are incubated or left in the incubator for 24 or 48 hours. At the end of the incubation period, the presence or absence of gas is noted.

(12) If gas is present in any of these tubes, the sample is reported as positive in the number of tubes which showed fermentation in this final step.

From this you may see why water samples are reported as positive in one-10cc portion, two 10cc portions, or three 10cc portions, etc., and in one 1cc portion. If this explanation appears obscure or is not clear to you, please write in and we will attempt to clear up any portions that you can. From these explanations it is hoped that you may see why we are very positive when we say a sample is good, or a sample is bad. The laboratory proceeds under the theory of check and double check. It is not a simple task to run water samples. The person performing this work must be skilled and experienced.

This article by Mr. Roberts appeared in the Arizona Water Works and Sewage Operators' Assn. bulletin, an excellent mimeographed publication issued from time to time, and which we find contains many practical and useful articles.

Tastes and Odors in Lake Winnebago Water

Lake Winnebago, in Wisconsin, has an area of 105 square miles and a maximum depth of 20 feet. Vegetation flourishes in the shallow waters and every year algae grow abundantly, causing tastes and odors that led the Indians to give it its name, meaning "stinking water." In spite of this, several cities take their water supply from this lake and its outlet, Fox River, employing treatment to render it palatable as well as safe. Among these cities are Oshkosh, Neenah, Menasha and Appleton. The mild winter and warm spring of 1939 caused unusually difficult conditions, which are described by the waterworks officials of these cities in "Taste and Odor Control Journal," from which the following is abstracted:

A count of algae taken early in August indicated 5,000,000 micro-organisms per gallon, principally diatoms. Appleton found as high as 6,000 C.S.U. per cc. The water in the lake presented an unbroken surface of green closely resembling a newly mowed lawn. Filter plants were clogged, runs being reduced 87% in Oshkosh. Threshold odors reached 130 in Oshkosh, 180 (hot) in Neenah, 300 in Menasha.

Powdered activated carbon was used by all these cities as one remedy for tastes and odors. Oshkosh had previously produced a palatable water by use of 1 ppm of carbon for each treshold unit, but last year did not succeed when using 150 ppm at 130 t.o. However, by splitting the dose, applying 4 ppm to the filter affluent, the dose to the mixing basin could be reduced to 110 ppm.

Neenah tried copper sulphate in the coagulating basin but found that impracticable amounts would be needed. Chlorine dosed up to 7 ppm was ineffective. Superchlorination followed by dechlorination was tried; but the "break point" apparently was not reached with a dose of even 50 ppm. The regular treatment used was activated carbon, from 82 to 145 ppm during August and September.

At Menasha the raw water is taken through a revolving screen, then treated with prechlorination and ammoniation, aeration, alum and carbon, settling, rapid sand filtration with carbon on the filters, and post chlorination. Spray-type aerators gave approximately 20% to 30% reduction of odor. A final threshold odor of 2 to 5 was obtained with the use of 150 to 170 ppm of carbon, of which 110 to 130 ppm was applied to the raw water in the mixing chamber and the balance directly on the filters without causing appreciable loss of head. During the period of high carbon dosage as high as 9 grains of alum was used to coagulate and settle the algae and carbon and reduce the color.

At Appleton, aeration reduced the odor 40% to 50%, sometimes 60%. Carbon made a further reduction, but this was sometimes as low as 5%, probably because decomposition of sludge in the settling basins offset its effect. Samples from one of these basins showed 3 to 10 bacteria per cc at 2 to 7 ft. depth, but 17,000 to 300,000 at 12 ft., indicating vigorous sludge decomposition. Chlorine at 6 ppm doses increased the odor from 30 t.o. to 45 t.o. Increases up to 31 ppm failed to show any "break point." Removal of the free chlorine by thiosulphate reduced the doors to as low as 15 t.o. when using 19 ppm.

The Editor's Page

Maintenance Is an Essential in Preparedness

Getting prepared is of vital interest to all of us now; the nation as a whole realizes for perhaps the first time that provision must be made to take care of ourselves. But preparedness does not mean solely the building of warships and the manufacture of guns and planes. Back of all that is the necessity of so ordering our daily lives that the final steps of preparation can be carried on most efficiently.

Many of our readers are charged with the responsibility of safeguarding the investments of very great sums in highway systems, in water works plants, in airports and in other public works. Their share in any preparedness program is to maintain these essential structures so that they will serve the people of the nation effectively without any possibility of breaking down. We cannot afford to let our highways deteriorate, for highways are a vital element in national defense, as in national life. Careful, methodical and daily attention must be given them. This means not alone patching holes, but the carrying on of the usual resurfacing and improvement operations which, after all, are but steps in the broader conception of maintenance. It means also the construction or reconstruction of needed highways, including adequate bridges.

In other fields of public works, the needs for careful maintenance and upkeep and for extensions and construction should not be forgotten. Water works, sewerage systems and refuse disposal installations are important parts of our health protection machinery. To neglect them is shortsighted economy and a disservice to the country. If putting them into a perfectly sound condition require that something be done "sooner or later," it should be done now—later the necessity may arise when neither men, material or time are available.

Those in charge of these works have a duty just as important as the manufacturer or the army or navy officer who assists perhaps more directly in our present preparedness program. They can serve best by bearing in mind the importance, to the community and to the nation, of the proper maintenance, at a high efficiency, of these public works.

Why Publish Municipal Reports?

Several times during the past few years we have explained our own ideas and those of others as to what the annual report of a municipal public works department should be like. Stated generally, we believe the purpose of such a report should be to explain to the citizens what the department has done during the previous year in the use of the utility it controls for their service, and how it has spent the funds entrusted to it; also explaining what improvements and extensions are needed and why. And that all of this should be so presented that the citizen of average intelligence can understand it and is even tempted to read it by its manner of presentation.

This means clear, brief descriptions in non-technical language; illustrations (photographs or drawings) each of which actually conveys some information; and absence of minute details or long tables.

As usual, this editorial is suggested by a report that has just reached us. This report, by a water department, contains 90 pages, of which 5 pages are text, 7 are illustrations (2 of them photographs of the board and personnel), and the rest tabular matter in great detail. Even the 5 pages of text tell little, except to describe what kind of information can be found in the 50 tables. We question whether more than five percent of the matter in this report is of interest to more than one percent of the citizens, or to the superintendents or water works officials of any other cities.

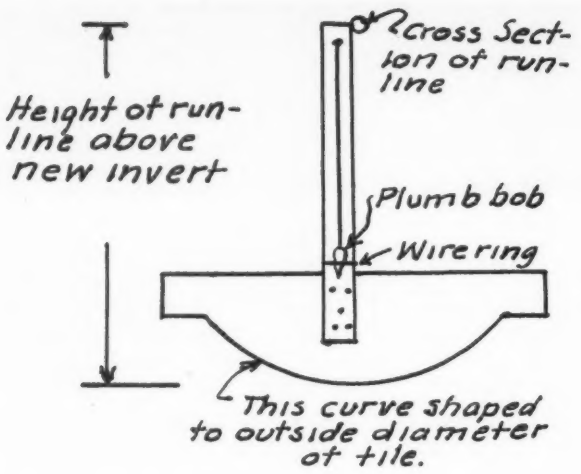
Even more important, there was a failure to utilize an opportunity to promote a cordial relation between the consumers and the department, to stimulate an interest in their plant and a confidence that the officials are doing a good job in giving them good service at reasonable cost. A ten-page report, five of them illustrations, carefully and wisely prepared, with an offer to furnish details to any who wish to call at the office, would have been of vastly more benefit to both the department and the citizens.

We suggest that a superintendent, before he writes a report, take the time to talk to two or three typical non-technical citizens, asking them what they would like to know about the plant and the year's work of the department; perhaps to tell them about it in more or less detail and note what appears to interest and what not to interest them. Then, when the report is written, submit it to two or three other citizens and to two newspaper editors, one pro-administration and one anti-administration, and ask them to criticize it as to what it tells, what it does not tell, and the manner of telling. This takes time and thought; but, for a public official especially, it is important not only to do a good job but to have the fact known and appreciated.

Instructing Elective Officials in Water and Sewage Treatment

In one of the many interesting comments we have received regarding the leading article in the April issue on short school instruction is the germ of an excellent idea. This writer suggests that we prepare an article on "Instruction of Elective Officials in the Operation and Management of Water and Sewage Treatment Plants." In return we have asked for suggestions and ideas, and we extend this invitation to all who read this.

This is actually an important question. We have long felt that there is too often something lacking in the relations between the elective and the technical officials. While too many of the elective officials, in the words of one engineer "think that their election makes them experts on engineering," too many of the technical officials refuse to go out of their set ways to enlist the interest and the support of these elected men. Any article on this subject ought to show the technical men procedures they can follow to acquaint the non-technical men with the needs of the community and to interest them in the steps that are being taken to meet these needs. Suggestions and comments are welcome; send them on.



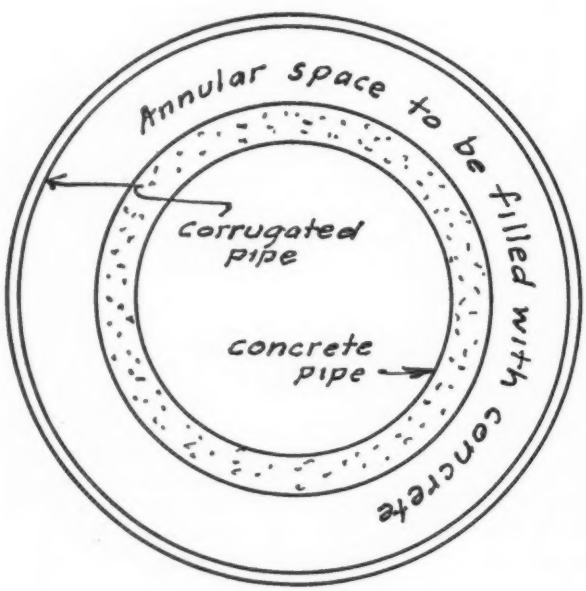
Laying Heavy Concrete Pipe in a Restricted Space Under a Fill

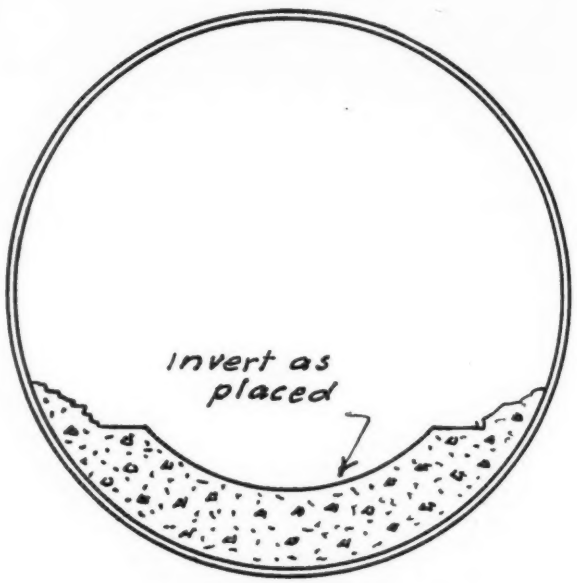
By R. V. TERRILL
City Engineer, Coldwater, Michigan

IN PLACING utilities under a railroad without disturbing railway traffic, one method is to jack a corrugated metal pipe through which will serve as a tunnel and then lay the sewer or other utility through this casing. The method is probably common enough to obviate the necessity for any detailed discussion, but in such a project recently this city did happen upon a way to lay quite heavy tile to grade and line through the casing. The method was new to us at least, and may be worthy of comment and also of value to others.

The sewer was a 24-inch reinforced concrete culvert tile with tongue and groove joints, each section of the pipe weighing around 800 lbs. The outside diameter of the tile was nearly 30 inches. The corrugated pipe which we jacked through to serve as a tunnel was 42 inches in diameter and 30 ft. long. Between the outside of the sewer pipe and the inside of the casing there was an annular space 6″ wide which the engineers of the railroad requested should be filled with a lean mixture of concrete. This, it appeared, was not so much for structural strength as to be assured against settlement should the outer casing ever disintegrate.

With the casing in place, our problem seemed to be to lay the heavy pipe sections through it and hold them somewhere near grade and line while we placed the concrete around them. We finally decided to lay a concrete subgrade, let it set and then slide the pipe sections into place, putting the remaining concrete around





the sides and top of each tile as it was laid.

To form our subgrade we made a wooden template or strike with a curve conforming to the outside curve of the sewer pipe. Secured to this template was an upright piece of 1″ x 2″ some 24″ long. This was squared with the template and its right edge set on the center of the template. From the top of the upright and hanging nearly its full length we suspended a small plumb bob, which was damped from swinging by hanging in a wire ring at the lower end. Thus when the bob hung in the center of the ring we knew that the upright was vertical and the template was level. We next placed a fishline through the casing and set it 24″ above the calculated invert grade of the tile. This was also carefully aligned. All that remained was to keep the runline in the clear and throw in sufficient concrete, mixed fairly dry, to cover about one-third of the lower circumference of the casing, and then to strike off this concrete with the template, keeping the upright vertical and its upper right corner as close as possible to the runline. Thus a trough or sub-invert was formed in the fresh concrete in which the tile later were placed.

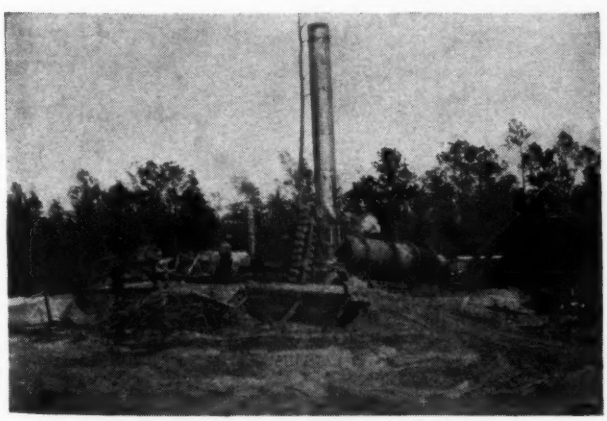
After the concrete had set, the tile sections were dragged into place with a sewer cleaning winch placed over a manhole a short distance downstream from the tunnel. I do not think any of these deviated from line or grade by more than ⅛ inch at any point. The accompanying sketches may give a clearer idea of the template.

Home-made spreader at work. Truck discharging into hopper.

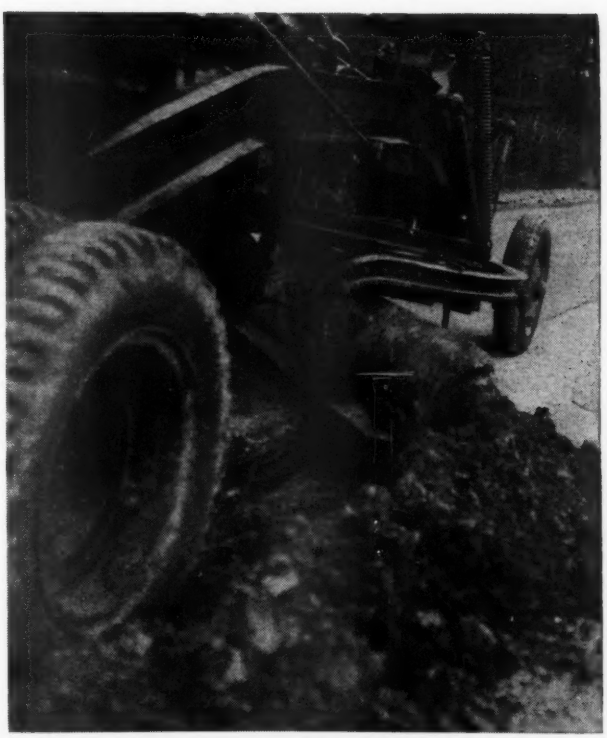
Road Widening With Sand-Asphalt Plant Mix

MAINTENANCE forces of the North Carolina State Highway and Public Works Commission, with state equipment were used to widen a long stretch of plant-mix highway near Bolivia, in the far southeast corner of the state. The old 16-ft. road is being widened to 20 feet by adding 2-ft. wide strips on either side of the road. The work is done under the general direction of B. W. Davis, Maintenance and Equipment Engineer of the Commission.

A mixing plant was set up at a sand pit near the Village of Bolivia. This plant consists of a Cedar Rapids drier, 60 ins. by 24 feet long with Allis-Chalmers Power plant; and a Hetherington & Berner pugmill mounted on a home made trailer and operated by an International power plant. This mixes the pit sand and asphalt, producing 10 to 12 cubic feet per batch. The sand is dug from the pit with a 4-yd. Bucyrus-Erie 2-wheel scraper drawn by a R 5 Caterpillar tractor, and discharged into a sump from an overhead bridge. A belt conveyor raises the sand to the drier. Cutback asphalt is used cold, at the rate of 5.7 gals. per batch.



The mixing plant, located at a sand pit, uses a Bucyrus-Erie two-wheel scraper for handling material.



The Galion grader with offset blade takes out a section for widening.

A fleet of Chevrolet and International trucks haul the mix to the road. These normally carry 7 batches of the mix, or about 3 cu. yds.

A Galion grader with an offset blade—a blade having one end offset so as to cut a trench 2 feet wide—in a single pass opens up the shoulder to the correct width. One or two men with shovels, doing such work as is needed, complete the job so that but one trip of

Rolling is the final step in widening—except the clean-up.

the grader is required. This work includes removal of the old plank side forms used for the original surfacing and then left in place as curbs. Another man follows along behind the grader and paints the edge of the pavement with asphalt.

The trucks dump the mix into a home-made spreader box especially designed for widening. This consists of a wooden sled with an inclined ramp and bridge long enough to accommodate the trucks, which back up the ramp, onto the bridge and dump into a hopper. This hopper is open at one side, and is raised by a power take-off operating a hydraulic lift so as to dump to the open side, filling the widening strip. As soon as the hopper, which has a capacity large enough to handle one truck load of mix, has been filled, it is raised by the power takeoff and the mix is dumped sidewise to the widening strip. A strike-off blade at the rear of the opening assures that the correct amount of material is delivered and no more. The entire spreader unit is hauled by a McCormick-Deering wheel tractor.

Two rollers were used on this job—a Galion and a Huber. These compact the widening strip as shown in the illustrations herewith. Following compaction, the old plank side forms are removed and burned or hauled away, and the shoulders refinished by blading with the grader, completing the job.

Water Pressure Lowered to Encourage Payment of Back Bills

An interesting technique for encouraging the payment of delinquent water bills is being used by the Lakeview, Ore., water company. Instead of turning off the water completely when the consumer becomes delinquent, the company attaches to the water meter a device which slows the flow down to a mere trickle. The manager of the company states that, after waiting ten minutes to obtain a glass of water or four days to fill the bath tub, the delinquents usually are eager to pay back bills—American Public Works Ass'n.

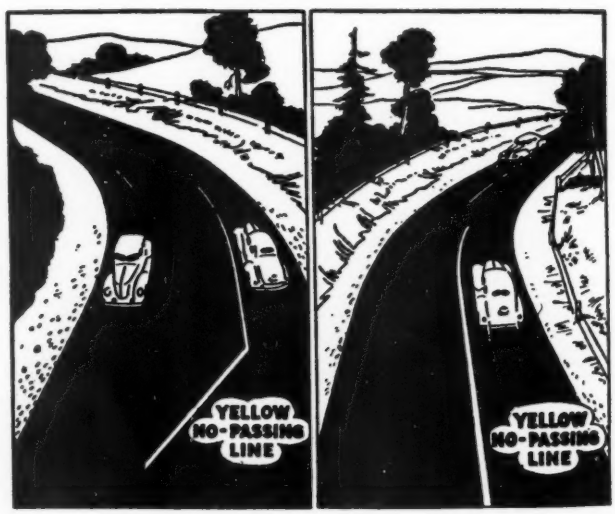
Yellow Stripes for Ohio Traffic Control

WORKMEN in the Ohio department of highways are painting white, black and yellow stripes on the 18,000 miles of state pavements so automobile drivers may protect themselves against accidents. Wherever the yellow stripe is in the driver's lane of traffic, that driver must not cross into the opposing traffic lane, but where the yellow stripe is in the opposing traffic lane, the driver may cross over for the purpose of passing other cars provided traffic conditions are such that overtaking and passing may be completed with safety.

The yellow stripe which is four inches wide is being painted alongside the four inch wide white or black center line, three inches removed. This auxiliary yellow stripe is being used on roads where approaches to hills cut down the sight distance, where visibility at curves is restricted, at approaches to railroad crossings, and in all areas where conditions will not permit motorists to cross the center line with safety because it is impossible to get an unobstructed view of the highway ahead.

On all the principal state highways continuous center lines on two lane road, and continuous lane lines on multiple lane roads are being painted. The center lines and lane lines are white on dark colored pavements and black on light colored pavements.

Use of the yellow stripe on highways where there is a possibility of accident—that is where sight distances are restricted—followed exhaustive tests by the highway department to determine what type no-passing markings were most effective in keeping motorists to their side of the highway. Results of these tests indicate that the yellow stripe brought better and quicker obedience to the warning than had been the case where the double white line, or several other types of marking to indicate no-passing zones had been tried at hazardous points.



Consumers' Soap Bills Cut by Softening Plant

The $680,000 water softening plant in St. Paul, Minnesota, will save consumers $250,000 a year in soap bills alone. The plant, with a capacity of 75 million gallons per day, will cost some $65,000 a year to maintain, but no increase in water rates is contemplated. The raw water has a hardness of 125 to 180 p.p.m. and is reduced by the softening process to 50 p.p.m.—Public Management.

The wall partly built. Note connection for drain.

Crib-Type Retaining Wall Protects Street From Flood Damage

By A. H. SIEMER

City Engineer, San Anselmo, Calif.

The finished wall, which later withstood a severe flood.

THE main street of San Anselmo, Calif., is paralleled for some distance by a stream which at times reaches flood proportions. The protection of this street from undermining and erosion has been a problem of much concern to the city in the past.

The methods considered included either the use of steel piling or the construction of a retaining wall. If steel piling had been used, it would have been necessary to secure these to deadmen, and for economy to use them in groups at intervals, filling the intervening panels with logs or timbers. This was considered a less desirable form of construction than a retaining wall.

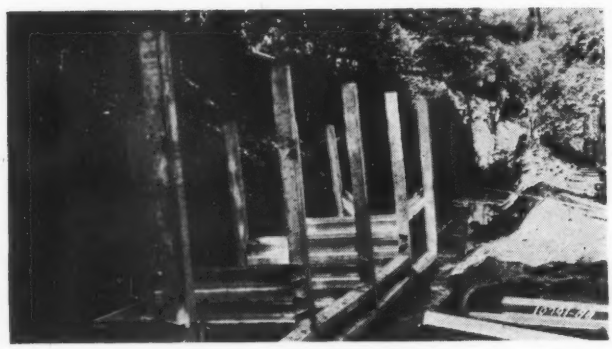
The material upon which the wall footing would rest was extremely poor, being a clay adobe, and this precluded the use of the usual type gravity or reinforced concrete wall. Therefore a crib-type retaining wall was chosen as being the safest form to use. Armco metal cribbing was selected in preference to timber as it was considered to have a longer life and it possessed the added advantage of being fireproof.

No unusual difficulties were encountered in excavation other than the removal of four or five old redwood piles which remained from an original bulkhead which had been built thirty years ago. Most of the excavation was done with a bulldozer—the final trimming being done by hand.

Dry concrete mix was placed under the bearing plates of the metal wall to assist in lining them up on a soft footing and in securing stability. These bearing plates

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 63-65

Preparing the foundation for the wall.



The second step in construction.

were approximately 3½ feet below the creek bed. The erection of the metal members went forward favorably in spite of the inexperience of the crew in handling what was to them a new product. Stages in construction are shown by the photographs herewith. An unusual connection was made to an existing culvert carried through the wall, a 24-in. corrugated culvert being welded in, as shown in one of the illustrations. This connection was very simple to install and worked out quite satisfactorily.

In installing retaining walls, especially on creek or river banks, it is necessary that drainage be provided at the rear of the structure to prevent excessive pressure behind the walls. In this case, drainage was provided for by filling behind and at the ends of the wall with coarse rock or old broken concrete. In addition, the filling of the wall was so carried out as to provide further drainage. The bins were backfilled in layers starting at the bottom with old broken concrete and coarse stone and gradually grading the materials finer and finer until the upper two feet were completed with loam.

The wall is 160 feet long and 13 feet 4 inches high. At the beginning of March of this year, we experienced our worst flood conditions in 15 years. The water went 3 feet over the top of the wall but the structure withstood these conditions satisfactorily — the only visible damage being a slight distortion in alignment and a loss of about 5 cubic yards of the top portion of the fill. The roadway was not damaged at all.

The principal merit of this form of wall is its flexibility under extreme conditions, but I do not believe that even the slight distortion mentioned above would have occurred had the fill had a year's time to settle under normal conditions. The town officials are pleased with the wall's performance structurally. As to its life span, the only data which we have is that afforded by the condition of corrugated culverts of the same metal and similar gauge and galvanizing, many of which are in good serviceable condition in this general locality after 20 or 30 years in the ground.

Water Brought From a Hot Spring for A Swimming Pool

Mineral water is piped five miles from natural hot springs to the covered municipal swimming pool at Salida, Colorado. Several engineering problems were encountered, the greatest being that of bringing the hot mineral water to the pool with a minimum loss in temperature. This was accomplished by using four-inch asbestos composition pipe. This supplies ample water both for the pool and for the adjoining baths, taking the water from the natural springs at 150° F. and delivering it to the pool at an average temperature of 110°.

The pool and bath building is of concrete block construction, with cement floors. The roof over the pool is supported by 11 steel roof trusses and at the peak is 31 ft. 6 ins. above the pool. The pool proper is 45 by 105 feet in size and ranges from 2 ft. 6 ins. to 8 ft. 6 ins. in depth. The concrete was poured in sections; sheet copper being used to seal the construction and expansion joints. The entire pool is surrounded by a concrete scum-gutter. Filtration was not provided because the water will be used but once, and there is a constant inflow of about 180 gpm. Each side of the pool has six submerged flood lights on approximately 14-foot centers. These give sufficient light to make all parts of the pool visible when lighted.

A unique and valuable construction feature of the pool is the pipe tunnel surrounding the three deep sides. This is 3 feet wide and varies from 3 to 7 feet in height. It gives access to all piping and electrical connections for the floodlights, and makes possible the inspection for leaks and other indications of failure.

The work was done with the assistance of the WPA, this being one of the fourteen pools so built in Colorado.

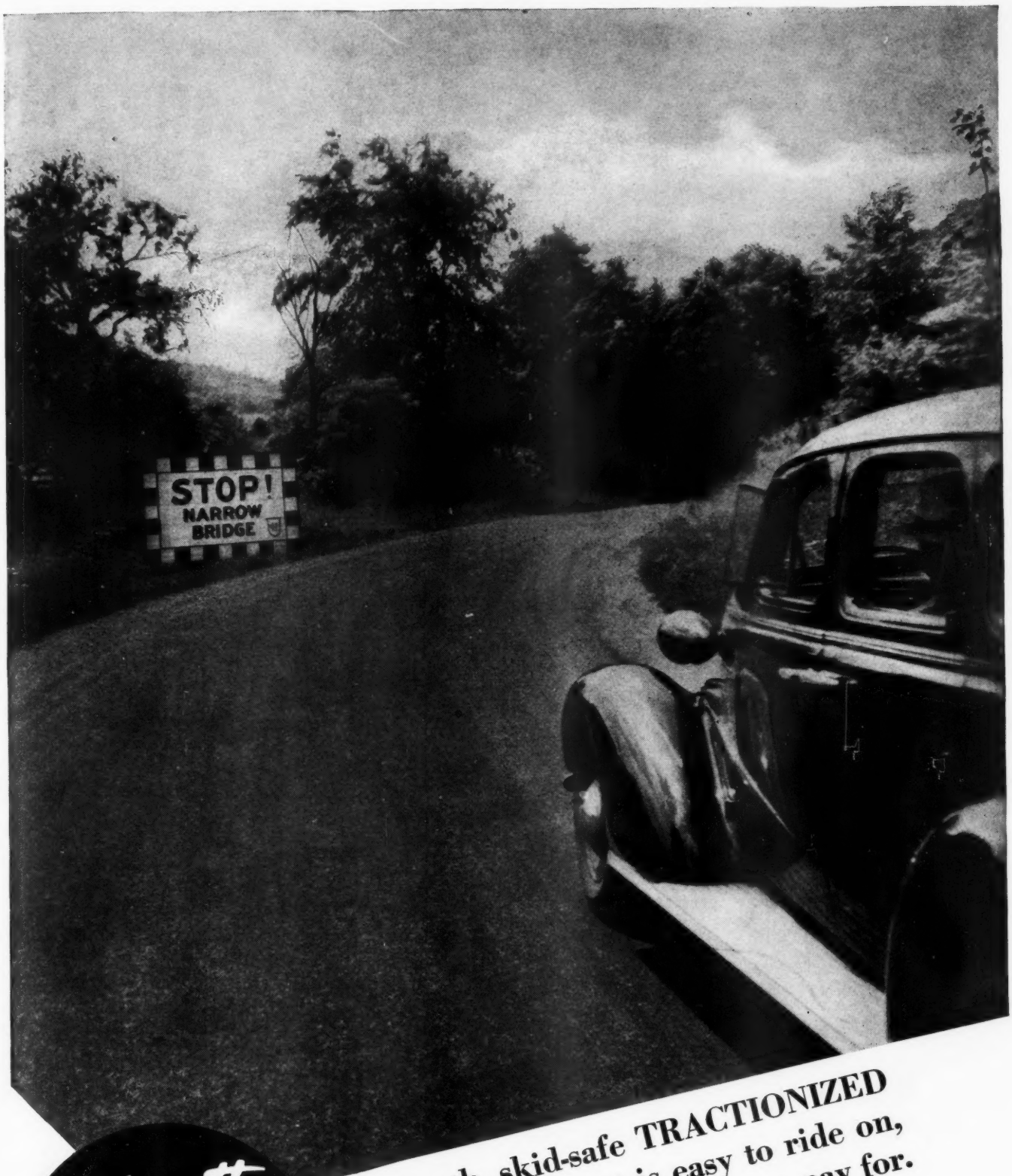
Aerial Movies to Study Traffic Flow

Los Angeles is experimenting with the use of aerial motion pictures as a means of studying traffic flow on its streets. A small motion picture camera, equipped with a wide angle lens, was mounted in an aluminum frame and attached to an 11-foot spherical balloon. Two guy wires, in addition to the main steel cable that controlled the elevation of the balloon, were used to hold the bag in position over the road and to act as transmission lines for the current that actuated the shutter release. Density and speed checks are obtained easily if the camera speed is known and a ground control is provided; types of traffic violations may be detected if the film is viewed through a hand-operated "editor" where it can be stopped and studied at any desired point.—Public Management.

Water Towers and Earthquakes

The west coast earthquake last May was an unusually severe one. Roads and fences were displaced as much as 12 ft. and many buildings were destroyed, and of six tall steel water tank towers in the seriously affected area, only two were undamaged, two collapsed completely, and the other four were seriously damaged, the bracing rods being permanently stretched.

Of the two undamaged ones, one had been designed with a lateral force coefficient of 0.1g, the other was an old tower that had been rebraced and strengthened to conform to the requirements of the Pacific Board of Fire Underwriters.



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When writing, we will appreciate you mentioning PUBLIC WORKS.

N. H. Rampe, E. W. Martin and John Lawrence.

Biofiltration for Sewage

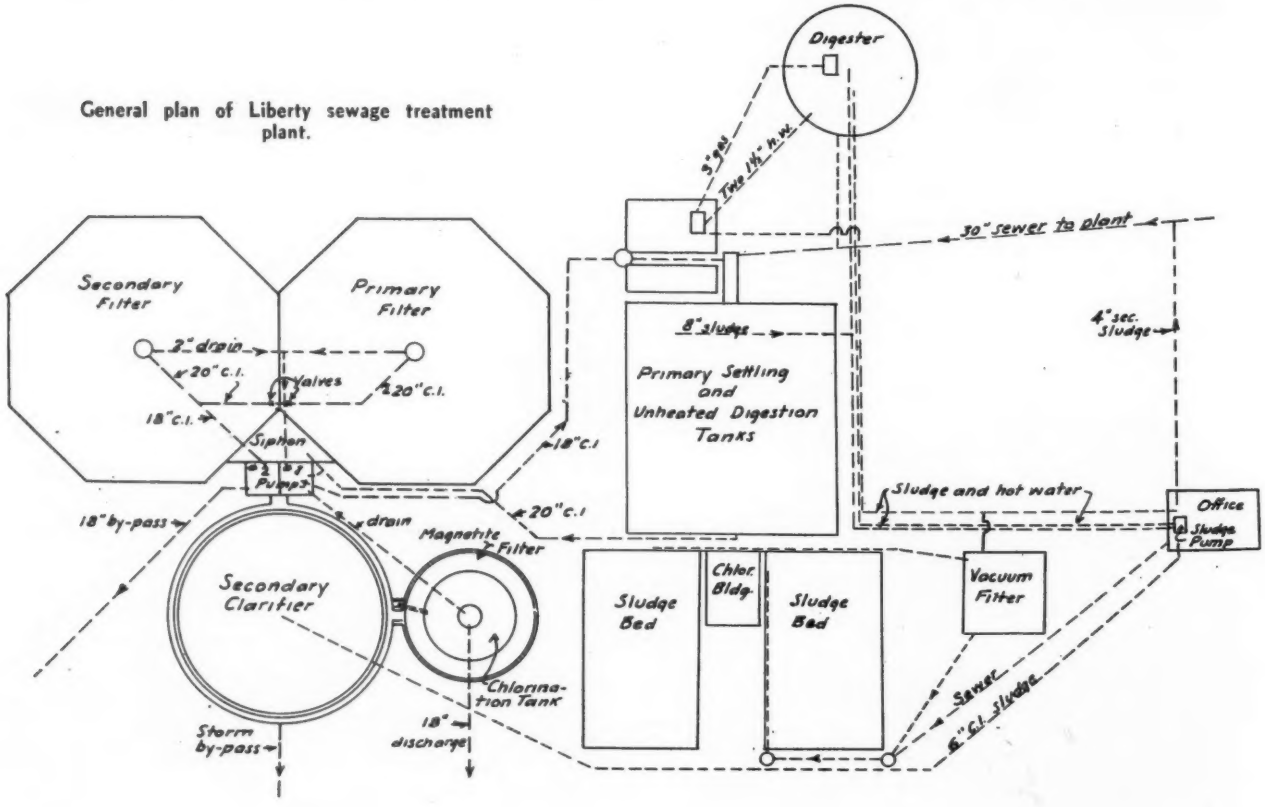
BIOFILTRATION has been selected as a means of sewage treatment at Liberty, N. Y., and the first plant of this type to be constructed in the East is now nearly ready to begin operation. The principal reasons governing the selection of this method of treatment were: 1. The necessity for a high degree of treatment during the summer months, and 2, the presence (often in high concentrations) of industrial wastes.

Liberty is the center of a summer resort area with the result that loadings are very high during the vacation season. Although the winter population is about 4,000, the summer population reaches 10,000. During the three months from June 15 to September 15, the normal flow of sewage is approximately 800,000 gpd.; during the remainder of the year, the flow is about 650,000 gpd. While the sewer system is of the separate type and every effort is made to exclude storm water, the volume of flow increases materially during storms. The summer daytime sewage is very strong, the BOD averaging about 425 ppm. Local dairies handle as much as 60,000 quarts of milk per day at times during the summer; two large laundries use approximately 75,000 gpd. of water. Peak loads on the plant have a population equivalent in excess of 20,000. The stream into which the plant effluent must be discharged has a drainage area of about 8 sq. miles, and the minimum dry weather flow does not greatly exceed the plant discharge during driest periods.

Existing Treatment Facilities

A primary treatment plant was built in 1931 and is still serving satisfactorily. All of it except the chlorination contact tank is being utilized in the present work, and no additions or alterations have been necessary except for connections to the new secondary treatment units. There are two rectangular settling tanks, each 70 ft. long, 16 ft. wide and 9 ft. deep, equipped with Link-Belt "Straightline" sludge collectors. These settling tanks are flanked by two unheated digesters of the flowing through type with essentially the same dimensions, providing 19,000 cubic feet of digestion capacity. There are two covered sludge drying beds, each 40 by 58 feet in area. There is a coagulation and

General plan of Liberty sewage treatment plant.



Treatment at Liberty, N. Y.

Description of the plant, just finished, which is the first in the East to use biofiltration. Includes two 80-foot filters and a magnetite filter, designed to treat one million gallons a day in summer and much less in winter.

Sprinkling filter floor completed in foreground. Old covered sludge beds in left background.

mixing tank, providing a mixing and contact period of about 30 minutes at average flows. A Link-Belt "Tritor" screen was added about four years ago.

The settling tanks were designed to provide 3 hours' detention with a flow of 1.125 mgd.; with recirculation, as used in the biofiltration process, the detention period will be from 70 to 90 minutes with usual flows. These tanks have been very efficient and, with chemical treatment, BOD removals by primary settling alone have been close to 80%. Aluminum sulphate has been used as a coagulant; but will not normally be so used after the completion of the new plant; however, the arrangement of the plant is such that it can still be used in connection with the biofilter plant, should it at times be desirable or necessary to improve primary settling. An application of 600 to 800 pounds per million gallons per day has produced excellent results. Despite the fact that the very strong sewage and the high degree of solids removal has resulted in large volumes of sludge—16,000 gallons per day or even more—and overloading of the digesters, the chemical sludge has digested well and dried very quickly on the beds. "Nuchar" activated carbon has been used regularly as an aid to digestion and, in addition, an alum solution is added to the sludge as it is applied to the beds. In ordinary summer operation, sludge has been drawn regularly each Sunday and removed the following Saturday. But during the summer months, the sand beds have been unable to handle the load, even with a 7-day schedule of drying, and the digesters overflowed almost continuously to the primary tank inlet, interfering with both coagulation and settling; the high alkalinity of the digester overflow resulting in a greater coagulant demand. To meet this difficulty, a Conkey vacuum filter was installed late last fall to reinforce the sludge beds, but has not yet been operated except for tuning in, since the beds have been more than ample for winter conditions.

The Problem of Design

The problem in design was to treat the very strong summer sewage so that it could not cause any nuisance or odor in the stream below the plant, utilizing methods that could be operated economically and efficiently during the nine months when the BOD load is light.

On the basis of BOD, the organic loading on the plant varies from about 1350 pounds as the winter average to 3500 pounds as the summer peak. It was considered necessary to produce an effluent having a BOD of not more than 20 ppm., and desirable to reduce this to 15 ppm., if possible. Three methods of treatment were considered: (a) Standard rate trickling filters, followed by sand filters to operate at 400,000 gallons per acre per day; (b) Activated sludge; and (c) Biofilters. With any of these, additional digester capacity would be necessary.

The standard rate trickling filters followed by second filters would have cost in excess of $90,000, exclusive of added digester capacity. Aside from the cost,

An excellent quality of concrete was obtained.

Mall vibrator on filter wall.

the problem of operating some two acres of sand filters under the summer sun within a few hundred feet of residences caused a great deal of concern on account of possible odors.

The cost of the activated sludge plant was estimated at about $50,000 (also excluding needed additional digester capacity). The principal objection to this method of treatment was the possibility that the strong milk and laundry wastes would interfere with operation. Milk wastes enter the plant at about 10 in the morning, in such volume and strength as to give a distinct gray color to the sewage. Laundry wastes enter in similar "slugs" in the afternoon, principally. On certain days, slaughter house wastes give the sewage a deep red color.

The cost of the biofilter plant was estimated at about $58,000, exclusive of the digester, but including a magnetite filter. The plant, as designed, included two 80-ft. biofilters; a secondary settling tank providing 1½ hours' detention for the flow, including recirculation; pumps; the magnetite filter, and a digester 35 ft. in diameter and 20 ft. deep. This method of treatment was selected primarily because it was considered likely to be unaffected by the industrial waste, and capable of producing a satisfactory effluent; and also because the design would permit the plant to be operated as a

BIOFILTRATION *at* LIBERTY

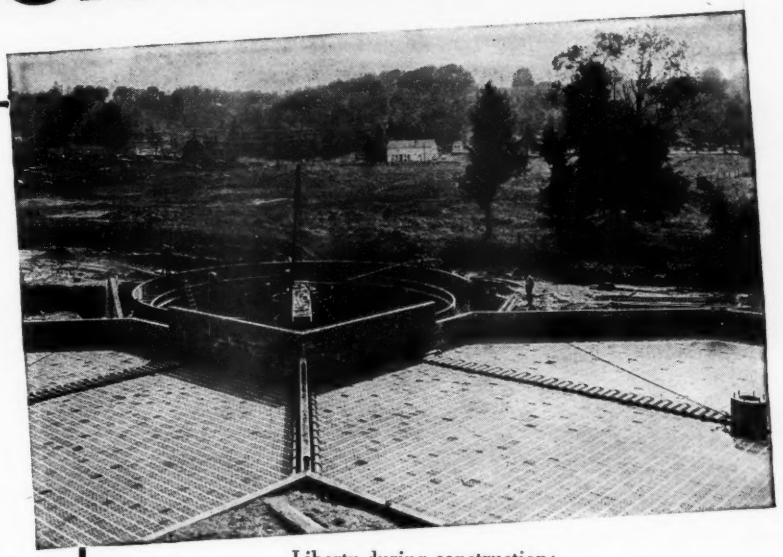
ADVANTAGES

Compared with Standard Trickling Filter Practice

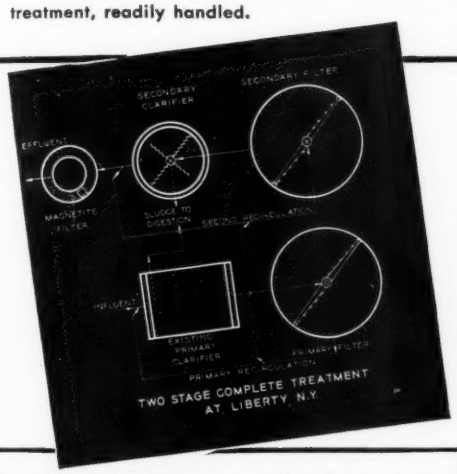
- Uniform final effluent regardless of feed fluctuations.
- Filter loadings up to 10 times normal.
- Shallow filters—3 ft. media depths.
- Installed costs 25 to 35 percent less.
- Operating costs 30 to 40 percent less.

Compared with Standard Activated Sludge Treatment

- First three advantages, same as above.
- Installed cost approximately the same.
- Operating cost, including fixed charges, 30 to 50% less.
- Expert supervision not required.
- Industrial wastes, not amenable to activated sludge treatment, readily handled.



Liberty during construction:
Bio-filters in foreground, secondary Dorr Clarifier in rear



Two-Stage Biofiltration at Petaluma, Cal.

Test No.	1	2
Flow—M.G.D.	.503	.500
Dosing Rate Raw—M.G.A.D.	5.05	10.6
Total—M.G.A.D.	17.2	37.1
Sus. Solids—PPM		
Raw	424	462
Final	33	43
Removal—percent	92.3	90.7
B.O.D.'s—PPM		
Raw	576	521
Final	14	28
Removal—percent	97.6	94.6
Raw B.O.D. Loading		
Lbs/cu yd/day	2.47	4.78

Each test represents a week's average results.
Analyses run daily on 24 composited hourly samples.
In test 2, the dosing rate was increased by blanking off a portion of the filter beds.

The first Biofiltration Plant in the East, at Liberty, N. Y., comprises complete primary and secondary treatment, digesters and an Automatic Magnetite Filter for a design flow of 1½ M. G. D. Total installed costs* are unusually low—$92,000 per M. G. D. Anticipated B. O. D. removals are unusually high—423 PPM in influent to 14 PPM in effluent—a reduction of 96.7 percent.

The Biofiltration System, marketed by the Dorr Company, comprises a combination of a Clarifier and a Filter, wherein the filter discharge is recycled back to the Clarifier. Single or Multiple Stage Systems may be employed to give results comparable with (a) Chemical Precipitation (b) Standard Trickling Filter practice or (c) Activated Sludge Process.

This System makes it possible for the first time to control completely the Trickling Filter—to obtain a uniform final effluent despite wide feed fluctuations—to permit up to 10 times normal filter loadings on beds as shallow as 3 ft.

Check the advantages cited above and the data from Petaluma, Cal. Then plan definitely to visit the Liberty, N. Y. installation in September to see for yourself.

*Cost, exclusive of digesters, is $58,000 against $90,000 for standard trickling filters and $50,000 for activated sludge.

● *In the meantime write for complete technical report on Biofiltration with operating data, alternative flowsheets, illustrations and cost comparisons.*

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ITALY: S.A.I. Dorr-Oliver, Milan • JAPAN: Sanki Eng. Co., Ltd., Tokyo • SCANDINAVIA: A.B. Hedemora, Hedemora, Sweden • AUSTRALIA: Crossle & Duff Pty. Ltd., Melbourne
ARGENTINA: Luis Fiore, Buenos Aires • SOUTH AFRICA: Edward L. Bateman Pty. Ltd., Johannesburg • BRAZIL: Oscar Taves & Co., Rio de Janeiro

Placing underdrains. Pier blocks in place ready for grills.

straight trickling filter during the nine months of low load.

The estimated cost of the biofilter installation, including the filters, secondary clarifier, pumps and pump sump, magnetite filter, digester and new office and operating building, with necessary piping and controls, was $75,439.60. Equipment was purchased separately by the Village at a cost of $27,063, and the contract for construction was awarded to E. W. Martin of Liberty at his bid of $48,849.74. The total cost of the plant, exclusive of engineering, legal, financial, etc., therefore amounted to $75,912.74.

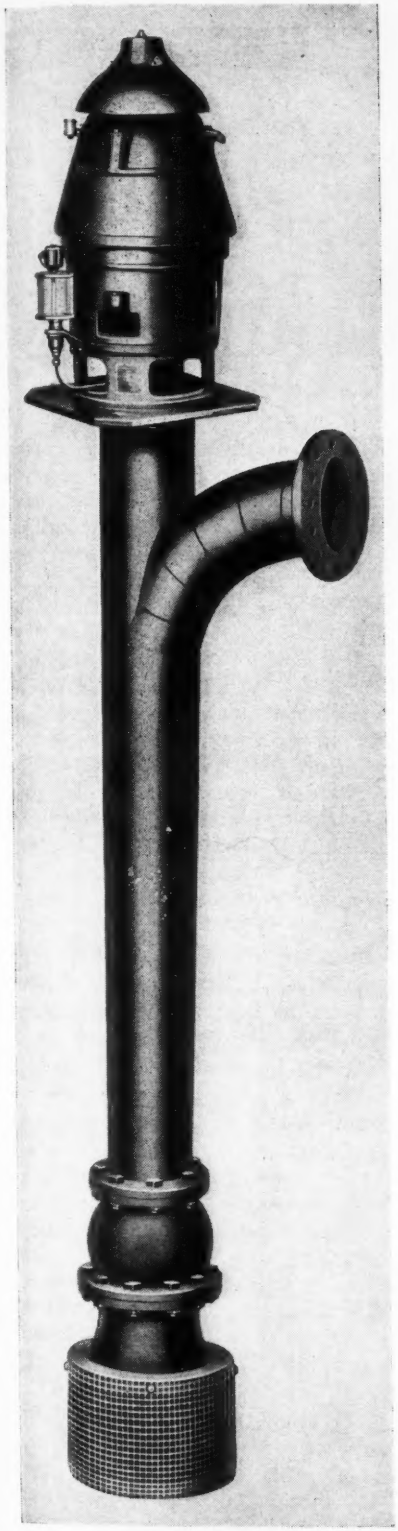
Design Bases and Details

The biofilters were designed to treat 1 mgd. of sewage having a raw sewage BOD of 425 ppm., the rate of BOD loading being 3.17 pounds per cubic yard of stone; 1117 cu. yards of stone therefore being required. Two 80-ft. filters were selected with a stone depth of 3 ft., and an octagonal shape was selected instead of the conventional circular form. As constructed, the BOD loading, on the basis of raw sewage volume and strength given above, is slightly less than 3 pounds per cubic yard of stone.

A recirculation ratio of 2:1 was adopted. At the assumed rate of flow of 1 mgd., 2 mgd. of the primary filter effluent is recirculated to the primary settling tank and mixed with the incoming raw sewage. On the basis of gallons per minute, which is more convenient, the raw sewage flow is 700 gpm; 1400 gpm of the filter effluent is returned to the primary settling tank, and 2100 gpm is applied to the primary filter. To the secondary filter is applied 2100 gpm, consisting of 700 gpm from the primary filter and 1400 gpm from the secondary settling tank. Distribution is by means of Dorr distributors, specially designed for these high rates of application.

The primary filter is dosed through a siphon, and the secondary filter through the secondary recirculating pump. Piping arrangements are such that sewage can be applied to both filters, or to either one, through the siphon, either with or without recirculation. By cutting out one pump, the plant can be used as a single stage biofilter. When more than about 200 gpm is being applied to the primary filter through the siphon, application is continuous, and the siphon does not break.

Stone in the primary filter are 2- to 3-inch pieces; and in the secondary filter, 1- to 2-inch, except that primary stone is used for the bottom 6 inches of the secondary filter. Filter floors slope 2 inches to a center drainage channel, 2 ft. wide and rectangular in



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UP-TO-THE-MINUTE design and construction . . . efficient operation . . . reliable service. Every engineer knows the important role these three essentials play in the proper selection of pumping equipment for sewage treatment. And, every engineer knows too, that for the ideal combination of all three, Fairbanks-Morse pumps just can't be beat. The selection of two F-M Fig. 6310 Propeller Pumps for continuous and uniform operation 24 hours each day in the Liberty, N. Y., sewage treatment plant reflects the confidence that has made them preferred everywhere. There's a complete double-line of F-M Propeller Pumps which enables you to get just the unit for your job. For information, write Fairbanks-Morse & Co., 600 S. Michigan Avenue, Chicago.

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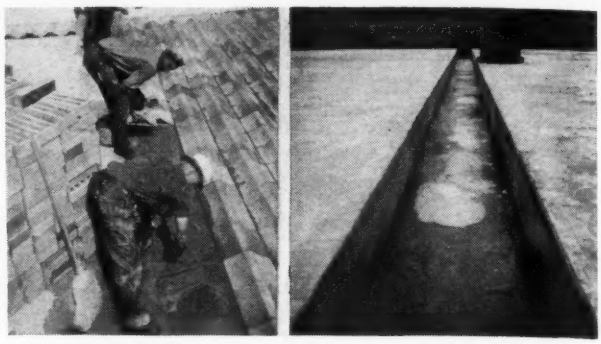

Channel of No. 2 filter showing offset from distributor pier.

shape, which is offset to clear the center pier support of the distributor. Inverted channel tile are used for center channel covers. The filter floor is of the two-piece type, manufactured by the Metropolitan Paving Brick Co. The lower or pier blocks of this floor form a series of parallel semi-circular channels with a cross-sectional area of 10.56 sq. in. The top or grill blocks have slotted apertures with a free opening area of 43%. These channels and openings permit maximum circulation of air while the filter is in operation. In laying the floor, the pier blocks were beveled to 45° at the angled walls; the upper or grill blocks are not beveled, but over the resulting triangular open or uncovered spaces at the wall is placed a line of inverted 8-inch channel pipe, extending entirely around the filter as a vent, with risers at the angles of the octagon. (In operation, it is planned to determine the effects of this additional ventilation by closing the vents for short periods.)

Pumps are Fairbanks, Morse & Co., propeller type pumps, designed to operate at a fixed speed and continuously, no matter what the flow of sewage into the plant. The primary pump has a capacity of 1400 gpm; the secondary pump 2100 gpm. Except for devices to stop the pumps at times of very heavy sewage flow or in case of a pipe breakage (when they must be restarted manually), there is no start and stop device, the design being such as to provide the necessary flow to them at all times. Storm flows at the plant have reached as high as 2.8 mgd., despite every effort to exclude storm water, and such flows with the added recirculated volume would approach dangerously near to flooding the plant. Therefore, a raw sewage flow in excess of 1.6 mgd. will shut off both pumps. The controls for stopping the pumps at predetermined high and low marks were furnished by Bender-Warrick Co. There is no provision for off and on operation of the pumps, and the sumps are so small that this is impracticable.

The provision of fixed capacity pumps operating continuously requires an assured flow to them at all times, irrespective of the flow of raw sewage. The primary pump received the flow from the primary filter and returns always 1400 gpm to the primary settling tank, the residue of the flow overflowing to the sump of Pump No. 2. Thus there is always a return of 1400 gpm and No. 1 pump is always sure of having its load. If there is no incoming raw sewage, there will be no overflow to sump No. 2 and Pump No. 1 will simply recirculate 1400 gpm. During minimum night flows, which may be only 0.5 or 0.6 mgd., the overflow to the sump of Pump No. 2 will be small—always equal to the flow of raw sewage. Pump No. 2 will take this flow and must draw enough additional to make up to 2100 gpm. There is only one place where this addi-

tional amount is always available, and that is the secondary clarifier, which is therefore connected to Sump No. 2 through an elbow connection in the effluent trough.

This arrangement has another advantage. In dry weather, when the flow of the diluting stream is at the lowest and the greatest degree of BOD reduction is necessary, the flow of sewage (including infiltration) is also lowest, and the recirculation ratio and consequently the degree of treatment will be increased.

Sewage from the primary tank enters the siphon chamber through a 20-inch cast iron pipe; the primary pump discharges through an 18-inch cast iron line to a manhole near the existing coagulation tank. This manhole permits the primary filter effluent to be mixed directly with the incoming raw sewage or to be passed through the coagulation tank and thence to the primary tank effluent, permitting further treatment if desired. A Brown and Brown check valve was installed in this manhole to prevent by-passing of the raw sewage to the pump in case the pump is stopped.

The effluent from the secondary filter discharges to the secondary clarifier. After satisfying the demands of the secondary pump, the residue is passed to the magnetite filter.

The secondary clarifier provides a detention period of 1½ hours for a flow of 3 mgd.; the overflow rate at 3 mgd. is slightly over 1000 gallons per sq. ft. per day. This clarifier, which is 60 ft. in diameter and 8 ft. sidewater depth, is equipped with the new Dorr clarifier apparatus. In addition to the usual peripheral overflow weir there is a central circular weir fastened to the influent well and connected by an outlet-trough under the walkway to the connection to Pump sump No. 2. This weir is designed to take whatever is necessary to supply Pump No. 2 before the peripheral weir overflows; normally it will take about 1400 gpm.

From the secondary clarifier, the residue, after the demand of Pump No. 2 is met, overflows to the magnetite filter. To provide protection to the magnetite filter in case of extremely high flows, a siphon overflow is built into the wall of the secondary clarifier, providing an overflow capacity up to about 5 mgd.

The magnetite filter is of the downflow type, furnished by the Filtration Equipment Corp. The filter bed has an area of 470 sq. ft., with a filtration rate at design flows of about 1½ gallons per sq. ft. per minute. Because of the low rate of operation, a magnetite sand was used having the following specifications: 98% passing a No. 20 U. S. Standard sieve and 95% retained on a No. 35 U. S. Standard sieve; this to be supported on a punched red brass screen with 0.012″ conical slotted perforations 5/32″ long.

The central circular section of the magnetite filter will be utilized for the chlorination contact tank, with final discharge directly to the creek. Chlorine will be applied by a Wallace & Tiernan chlorinator to the effluent of the secondary clarifier as it enters the magnetite filter.

General and Construction Details

By-passes have been provided so that almost any portion of the plant can be cut out of service, this being practically necessitated by the difference between summer and winter conditions. Filters can be operated with or without recirculations; the magnetite filter can

be by-passed, whenever desired; or settling and filtration alone can be employed. Chemicals can be used to improve settling if this should become necessary.

The Digester—To reinforce the present sludge disposal facilities, a new heated digester is being constructed. This will be 35 ft. in diameter and 20 ft. deep, equipped with Dorr apparatus. Gas will be burned in a Bryant heater; flame traps, gas burners, and similar equipment are by Vapor Recovery Systems Co. Piping arrangements are such that digested sludge may be passed to the existing unheated tanks for storage, to the vacuum filter or to the sludge drying beds. Secondary sludge is discharged into the sewer near the primary tank inlet to be settled with the raw sludge.

Office Building—All controls will be placed in the new office building, which will be 18 by 28 ft., one story and basement, brick, with tile interior. The main floor consists of a laboratory, an office and record room, and a shower and wash room, grouped around a central hall. In the basement will be the sludge pump and tool storage. Heating will be by hot water from the sludge heating equipment. Bottled gas will be used for laboratory work. Simplex Valve & Meter Co., which furnished the flow measuring device for the original plant, are replacing this with a newer device, which will provide several added advantages.

Construction—Every effort is being made in construction to have a plant of attractive appearance. For concrete for the filters, shiplap forms were used; for the clarifier and digester, plywood forms. Concrete is designed for a strength of 3500 pounds. Master Builders Co. "Pozzolith" is being used as an admixture for the concrete, in the proportion of 2 pounds to the bag of cement, which has resulted in the saving of approximately 700 bags of cement and because of increased workability has eliminated honeycombing and similar difficulties. With a Mall vibrator, tamping and forking has been unnecessary, and the walls have been smooth and uniform. Ryerson furnished the reinforcing steel; and Nazareth portland cement is used. A T. L. Smith 7S mixer has done most of the work. On excavation, a Byers shovel and a Caterpillar-LaPlant-Choate bulldozer combination were used.

All cast iron pipe and fittings were furnished by the Lynchburg Foundry Co. Valves were supplied by the Kennedy Valve Co.; sluice gates by Mueller; and aluminum slide gates (and also aluminum grating) by H. J. Thelen Bronze Co.

The contract for construction is being carried out by E. W. Martin of Liberty, with whom is associated N. H. Rampe, also of Liberty. John Lawrence is superintendent of Public Works of the Village and Harry Eichenouer is operator of the existing plant and will continue in charge of the new plant. Edward Hallenbeck is inspector in charge of construction. W. A. Hardenbergh designed the plant and is in charge of construction. Village officials are: Albert Van Dyke, Mayor; Melvin Heidt, Paul Killian, Harold Schue and David Brock, trustees; the Broad of Sewer Commissioners is composed of Merton C. Sprague, Chairman; Frank Travis and Ross Comfort. Construction started April 15, 1940.

A PORTABLE ENGINEER'S OFFICE

The field engineer of the Galesburg, Ill., Sanitary District uses a portable office built in a trailer. In this are a desk, large drafting board, lights and telephone. The trailer is hauled to the site of any construction job which the engineer wishes to supervise and connected to a power line and telephone line.

Electric Motors and Controls for Sewage Treatment Plants*

By J. O. KAMMERMAN

Professor of Electrical Engineering, South Dakota School of Mines.

EITHER ball or sleeve bearings are now available for most motors. In general, ball bearings should be specified, except for motors above 1200 r.p.m. Sleeve bearings should be used above 1200 r.p.m. and the motor should be mounted so that the sleeves are in a horizontal position. The advantage in the ball bearing is less friction and less maintenance expense. Ball bearings, however, are greatly abused by over-lubrication. An excess of grease causes the balls to slide rather than roll which not only wears the balls but heats the grease and allows it to liquefy and run into the windings, where it does damage. The manufacturer's recommendations regarding the frequency of lubrication should be followed carefully.

The standard insulation used on most motors will withstand conditions involving moderate amounts of moisture and weak acids. This insulation may prove satisfactory for certain applications in sewage disposal plants, where the motor is not subjected to any moisture or acid fumes. It is my opinion that, in general, splash-proof motors should be employed in most places around sewage disposal plants. These motors should have special insulation which will withstand excessive amounts of moisture and acid vapors. No insulation can be considered as "proof" against these conditions, but it can be made "resistant" against them by special treatment and impregnation.

Where totally enclosed motors are used to prevent explosions, special insulation is not required.

The temperature rise that should be allowed is as follows: open motors 40° C, splash-proof motors 50° C, totally enclosed motors 55° C.

Motor Control Equipment

The purpose of motor control equipment is not only to start and stop the motors, but also to regulate and protect them, to indicate and record the power consumed, to act as the brain of the electrical system. There is a vast difference between the first controllers, consisting of simple rheostats or open knife switches, and the completely enclosed, stream line control boards of today, entirely automatic, and almost human in their precise and accurate direction of the motor operations.

The load on pumps, screens, collectors, and many other machines used in sewage treatment plants or pumping stations is constantly changing, so the motors driving these machines must be accurately and automatically controlled and regulated to keep the treatment cycle operating smoothly and to eliminate useless waste of power. For example, it may be advantageous to have a variable pumping capacity, and to have this capacity controlled automatically so that any change in the volume of incoming sewage will reduce or increase the pumping capacity to meet the new condition. Similarly, automatic operation of bar screen cleaning mechanisms is often accomplished by means of float switches, actuated by increases in the height of the sewage ahead of the screen. Operation of this apparatus by hand might prove inefficient and cause delays, while operating it continuously at a constant speed would require more power than necessary.

The selection of control apparatus presents several problems, which, for purposes of discussion, can be grouped as follows:

1. Incoming line equipment.
2. Types of motor controllers.
3. Physical construction.

When specifying the incoming line equipment, it is very important to have the equipment of sufficient rupturing capacity and of the proper mechanical strength so that, in case of a short circuit in the system, the device is not liable to be damaged or destroyed.

Power is usually purchased from some power company and it is well to consult the engineer of this company concerning the necessary information regarding the incoming line equipment.

When selecting control apparatus, the engineer has the following list from which to make his choice:

1. Magnetic controller.
2. Semi-magnetic controller.
3. Manual controller.
4. Full voltage controller.
5. Reduced voltage controller.
6. Resistor type controller.

A magnetic controller has its basic functions, such as line closing, acceleration, retardation and reversing, performed by electro-magnets. If the electro-magnets are energized through a push button or similar device, the controller is hand operated. If energized through a float switch, time switch or other impersonal influence, the controller is automatic.

A semi-magnetic controller has part of its basic functions performed by electro-magnets and part by other means.

A manual controller has all of its basic functions performed by hand.

A full-voltage controller starts a motor by applying full line voltage to the motor terminals.

A reduced-voltage (auto-transformer) type controller starts a motor by applying part voltage to the motor terminals, and after the motor has attained part speed, increases the voltage to its full value.

A resistor type controller starts a motor with a resistor in series with the motor terminals, and after the motor has attained partial speed, shorts out the resistor, putting the motor directly on the line.

There is no set rule governing the type of control to be used. Where limited funds are available, the selection of control will be governed by the cost of the apparatus. Where funds are not the limiting factor, the control will be selected to afford the maximum efficiency of operation. The engineers designing the

*Continued from the June issue.

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 63-65

plant, in consultation with the electrical engineer and the manufacturer of the sewage disposal machinery being used, should select the type of controls which will economically give the operator of the plant easy control of all elements of the plant.

The question of where and how to mount the control apparatus must be decided separately for each sewage plant installation. Some plant operators prefer individual controls for each motor, mounted near the motor. Others prefer a centrally located board on which all control will be mounted. When making this decision, the following factors should be considered:

1. The distance between motors. If the motors are too widely separated, the cost of running control and power wires to a central board may be excessive.

2. Advantages of centralized control board. Meters and gauges on this board will give an accurate and continuous picture of what is happening at the various machines. All machines can be quickly controlled from one point.

3. Corrosive gases. If the motors are located where they are subjected to corrosive action of sewage gases, it may prove advantageous to locate the control at a remote point. Usually the switchboards are mounted in a well-ventilated room away from the open sewers.

4. Cost. Usually the use of standard individual motor controllers will keep the total expense at a minimum. However, if special control is required for a motor, the cost of mounting this control on a switchboard should be no more than the cost of mounting it on a separate panel.

Maintenance

The size of a motor and the cost of maintenance are associated. If a motor is too small for the work it is required to do, frequent repairs will be necessary on the motor. If the motor is too large for the work it is to do, there will probably be frequent repairs on the apparatus it is driving, for if anything goes wrong with the apparatus, the cut-out on the motor very frequently does not operate until the apparatus is damaged or possibly completely wrecked. Manufacturers are familiar with the amount of power required to operate their equipment, and engineers and city officials, when purchasing various types of equipment should get the manufacturer's recommendations as to the size and type of motor to be used with his equipment and should abide by the recommendations which they receive from the manufacturer. No manufacturer is going to recommend a size of motor which will damage his equipment, nor will he recommend a size of motor so small that his equipment cannot be operated to full capacity.

Electrical manufacturers are now placing on the market motors which have extremely long lives when properly applied and given the proper treatment. Too often after motors and control apparatus have been installed they are given no further attention, outside of occasional oiling, until something goes wrong. When motors are so treated, the owner is inviting disaster. All electrical apparatus should be inspected periodically. Minor defects might be discovered which can easily be remedied, which, if not given proper attention, would in time cause considerable delay and expense for repairs.

Too much emphasis cannot be placed upon the importance of periodic inspection. Too often the policy of keeping your fingers off of apparatus as long as it works satisfactory is followed to the detriment of the apparatus. Periodic inspections of controls and motors will often reveal minor defects which can easily be remedied but which, if allowed to go without attention, will de-

velop into trouble, probably causing shut-downs and the cost of major repairs.

I also want to warn against that type of operator who is never satisfied with the adjustments of apparatus as it comes from the factory. He is the type that usually starts to readjust the apparatus as soon as the engineers in charge of the installation have left. This is bad business. The apparatus delivered by the manufacturer and accepted by the engineer should only be adjusted when it is definitely known that such adjustment is imperative to the efficient operation of the plant.

In closing, I wish to acknowledge receipt of very helpful information from the Chicago Pump Company, of Chicago, Illinois; the Chainbelt Company of Milwaukee, Wisconsin; the Dorr Company, Inc., of Chicago, Illinois; and the district office of the General Electric Company, at Denver, Colorado

This is the conclusion of an article by Prof. Kammerman which appeared in "The Clarifier," publication of the South Dakota State Board of Health.

Old and New Sewage Equipment at Plainfield

THE Plainfield, North Plainfield and Dunellen (New Jersey) sewage treatment plant was put into operation in November, 1916. Many changes have been made since then, and new ideas are always being tested out to keep the plant up to or ahead of the standards of the moment.

The first important addition was a Reinsch-Wurl screen in 1918. This operated for 21 years, 24 hours a day. It has recently been replaced with a comminutor to eliminate odors and necessity of handling the screenings. The screen gears were worn to knife-edge thinness and the main shaft collapsed on removal—but after 21 years of constant use! It certainly owed them nothing.

Two dosing tanks for sprinkling filters had operated for the same period, the only repair having been renewal of a vent pipe due to corrosion. These were replaced last year by twin siphon equipment, not because of failure or wear, but to permit continuous spraying for fly control.

The 1.78 acres of sprinkling filter 6 feet deep are operated at a constant rate of 7 mgd in summer, enough final effluent being returned to the dosing tanks to maintain this rate as the flow of the raw sewage varies. This is effected by passing the influent to the dosing tanks through a a venturi meter which actuates a valve that controls the amount of return effluent. This effluent is taken from a final settling tank that provides an hour's detention, supplemented with a circumferential magnetite filter through which the effluent passes at the rate of 2 gal. per sq. ft. per minute.

Other additions to the plant include sludge disposal by spray drying and incineration; sludge dewatering by alum floatation; Tow-Bro sludge collectors in a resettling tank; pre- and post-chlorination; gas heater for heating digesters, and gas freezing equipment for dewatering sludge by freezing.

Concerning the last, J. R. Downes, supervising engineer of this plant, says: "We have found that freezing and thawing sludge destroys the sliminess and allows the water to drain off very readily. When the water is drained off we find the solids in a clay-like condition with a water content of 65%. With this low water content the sludge is, theoretically at least, self burning."

How to Be a Good Expert Witness

By NATHAN YOUNG

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A CLEAR understanding of the legal principles which govern the testimony of expert witnesses is essential to the intelligent preparation of testimony which very often is sufficiently important and effective to determine the outcome of litigation involving large sums of money.

An expert witness is one whose special experience, skill or training enables him to speak with authority on a subject with which the average person is not familiar. The engineer should find this matter of particular importance because it is not uncommon for persons in the engineering field to be called upon to render an opinion on a technical subject which will enable the court and jury to determine a lawsuit.

Before, however, discussing such testimony, it is of value to briefly examine the legal procedure or machinery by means of which a dispute between two parties results in a trial before a court and a jury.

Let us assume that A, by a contract in writing with B, has undertaken to construct a building on land owned by B at an agreed price and in accordance with certain plans and specifications. During the progress of the work, A has performed certain labor and furnished certain materails which he claims to be extra to the requirements of the plans, specifications and contract. B disputes this claim. In addition, B claims that certain plumbing fixtures installed by A do not conform to the requirements of the plans and specifications and desires to deduct from the contract price his damages for B's improper performance in this respect.

Thereupon, A's attorney, in order to obtain legal redress from B, causes to be served upon B a summons issued out of the proper court, but signed by the lawyer, in which B is notified that A has a claim against him and B is given the statutory period of time within which to appear in the law-suit. A is commonly known as the Plaintiff and B as the Defendant. In addition, A's lawyer causes to be served upon B a complaint in which is set forth briefly the substance of A's claim against B. B's lawyer, then, causes to be served upon A's attorney a paper known as the Answer which states B's position with respect to A's claim, *i. e.,* his denials of A's assertions and special defenses thereto, and, in addition, contains a concise statement of any counterclaim which B may have against A. To this counterclaim, A's lawyer will serve upon B's lawyer a reply which will set forth A's position with respect to B's counterclaim. Thus, the issues of the litigation are fixed and determined.

Shortly thereafter, either lawyer may serve upon the other (usually the plaintiff's lawyer will serve upon the defendant's attorney) a notice of trial or note of issue to the effect that the case will be placed on the calendar of the court for trial. Proper papers are filed with the Clerk of the Court and the case is placed upon the calendar.

When the case is reached for trial, the first step is the selection of the jury. This consists of an examination of prospective jurors by both lawyers in order to determine whether they know any of the persons interested in the outcome of the case and whether they are in any way prejudiced in favor of or against either side.

After the selection of the jury, it is sworn. Plaintiff's lawyer then addresses them and explains briefly the facts which he expects to prove during the trial. The defendant's lawyer follows him with a like opening on behalf of his client. This serves to give the court and jury a preliminary picture of the contentions of both sides.

This is followed by the taking of testimony. The plaintiff's witnesses are called. Each is examined by the plaintiff's lawyer and cross examined by the defendant's lawyer. When the plaintiff's case is complete, the defendant calls his witnesses, who, in turn, are examined by the defendant's lawyer and cross examined by the plaintiff's lawyer. The defendant's witnesses answer the contentions of the plaintiff and present the defendant's counterclaim. Plaintiff may now recall his witnesses or may call new witnesses to reply to the defendant's testimony and finally the defendant may call witnesses to rebut plaintiff's testimony.

After all the testimony is in, the defendant's counsel delivers his summation in which he summarizes the defendant's claims, comments on the witnesses and their testimony, attempts to show the weaknesses in

the plaintiff's testimony, and pleads for a verdict in favor of his client. Plaintiff's counsel then sums up in like manner for the plaintiff.

After summation by both sides, the judge delivers his charge to the jury in which he explains the principles of law involved in the case. The jury then retires for its deliberations and returns with a verdict.

The determination of all questions of fact is solely within the province of the jury. The court alone determines the questions of law. Thus, in the charge to the jury, the court explains to the jury the law which must govern their deliberations and verdict.

The procedure outlined differs in minor details in various jurisdictions.

It may be stated as a general rule that a witness must confine his testimony to facts. He may not express an opinion or draw a conclusion from the facts to which he has testified. For example, he may state what was done in connection with the excavation of a site for a building, but he may not render his opinion as to whether the method used is a careful and scientific one and should prevent the caving in of the sides.

The rule excluding opinions of witnesses from the evidence is subject to two exceptions. First, in certain cases an ordinary witness may express an opinion. Second, in certain other cases an expert may be called to render an opinion.

An ordinary witness may express an opinion where he cannot otherwise adequately describe what he heard or saw. But even in such case, his opinion cannot be accepted in matters involving special study or skill. He may, for example, express an opinion as to color, weight, size, taste, odor, age, heat, cold, sickness, health, anger, fear, excitement, character and other matters which arise in the every day experience of the average man.

The testimony of the expert witness is received on matters the understanding of which requires special experience, training or skill. There are two classes of cases in which the testimony of an expert may be used. First, is that class in which an explanation of the facts requires special study or experience, but the conclusions to be drawn from those facts may be formed by a jury which consists of persons of ordinary experience. In this class of cases, the expert is permitted to state only the facts; the conclusion is drawn by the jury. An illustration of this type of case is the matter of Dougherty v. Milliken, which will be more fully discussed below.

In the second class of cases, are those in which not only the facts but also the conclusions to be drawn therefrom necessarily require the skill, training and experience of an expert. In this class, the expert may testify to the facts and in addition render an opinion. An illustration of this class of cases may be found in the case of Swarts v. The R. M. Wilson Manufacturing Company, which will also be discussed below.

In Dougherty v. Milliken, decided by the Court of Appeals in New York, in 1900, it appears that the plaintiff sued for personal injuries sustained by him as the result of the collapse of a derrick upon which the plaintiff was at work. The facts are as follows:

The defendant was in the business of iron and steel construction. The plaintiff was a laborer employed for two years prior to the accident. There were two derricks used on the job, about 60 or 70 feet apart. The mast of the larger one was 35 or 40 feet high; that of the smaller one about 30 feet high. The boom of each was somewhat shorter than the mast. Each derrick was supported by four guys fastened at different places. The only eyebolt used as an anchor was the one which broke and

caused the accident. It was about one inch in diameter and about 10 or 12 inches long. A guy from each derrick was fastened to this eyebolt which, in turn, was fastened to a stringer at the end of the dock. There was no evidence of any defect in the bolt.

Just before the accident, the plaintiff was directed to the top of the larger derrick to substitute wire guys for rope. At the same time, the smaller derrick was hoisting a 15 inch beam about 40 or 45 feet long, weighing about 1600 lbs.

While the plaintiff was thus at work, the derrick on which he was perched collapsed and he sustained serious injuries. To show neglect of duty on the part of the defendant, the plaintiff produced experts to testify that the eyebolt was not heavy enough and that fastening to it two guys from opposite directions produced such stresses as to cause it to bend and break. The court then discussed the evidence of experts in the following language:

"It may be broadly stated as a general proposition that there are two classes of cases in which expert testimony is admissible. To the one class belong those cases in which the conclusions to be drawn by the jury depend upon the existence of facts which are not common knowledge and which are peculiarly within the knowledge of men whose experience or study enables them to speak with authority upon the subject. If, in such cases, the jury with all the facts before them can form a conclusion thereon, it is their sole province to do so. In the other class we find those cases in which the conclusions to be drawn from the facts stated, as well as knowledge of the facts themselves, depend upon professional or scientific knowledge or skill not within the range of ordinary training or intelligence. In such cases not only the facts, but the conclusions to which they lead, may be testified to by qualified experts. * * *

" * * * If the knowledge of the experts consists in descriptive facts which can be intelligently communicated to others not familiar with the subject, the case belongs to the first class. If the subject is one as to which expert skill or knowledge can be communicated to others not versed in the particular science or art only in the form of reasons, arguments or opinions, then it belongs to the second class. * * *

" * * * The mere statement of this rule seems, of necessity, to place this case in the first class. The structure which collapsed and caused plaintiff's injuries was a simple derrick such as is common for the hoisting of heavy materials. The particular defect in construction alleged consisted in the improper anchorage of two derricks to a single eyebolt placed between them. Whether this was defective, and therefore negligent, construction depended upon the amount and kind of strain to which the eyebolt was subjected, its size, its inherent tensile strength and the character of its fastening into its base. These were subjects upon which the testimony of men skilled and experienced in the construction and use of derricks and their constituent parts could properly be received. But such testimony, within the limitations of the rule above averted to, should have consisted wholly of facts from which a jury of average intelligence could form a conclusion as to the safety or sufficiency of the method of construction employed. It was the province of the jury, not of the experts, to determine the latter question. In this view of the case, it was obvious error to permit the experts to express opinion which practically decided the only question which was to be submitted to the jury. * * * "

Illustrative of that class of cases in which the expert may express an opinion is the case of Charles E.

Swartz v. The R. M. Wilson Manufacturing Company, decided by the Appellate Division of the Supreme Court in New York, 1906. In this case, it appears that the plaintiff, who was employed by the defendant, was injured while operating a machine called a "shaper" consisting of a table near the middle of which, about 3 ft. apart, were two spindles about 1⅝ inches in diameter and 6 or 8 inches above the surface of the table. Upon each spindle were fastened two knives. The machine was set up in such manner that the spindles and the knives attached to them revolved inwardly toward the operator instead of away from him.

Machinists were permitted to testify that in their opinion the operation of the machine with the knives turning inwardly toward the operator was much more dangerous than with the knives turning away from the operator. The defendant claimed that allowing this testimony was reversible error because this matter was not properly the subject of expert testimony. The court, however, held as follows:

"It seems to me that the evidence was properly admitted and that the authorities cited by respondent's counsel fully sustain that proposition. The machine in question was of such a character that it is somewhat difficult to understand how it became more dangerous because of the fact that the knives revolved inwardly rather than outwardly. In fact, I confess that after all the discussion had by counsel upon that question, I am at a loss to see how it is so. But the machinists, sworn on behalf of the plaintiff and defendant alike, seem to agree that to operate the machine with the knives inwardly was attended with much more danger than if they revolved the other way. Under the circumstances, I think it was competent for the expert witnesses to say just that."

When an expert is called upon to express an opinion, he must necessarily base his opinion on the existence of certain facts. The expert may or may not be personally familiar with the facts of the case in which he is testifying. If he is, he may so state and proceed to express his opinion. But, if he is not, the facts must be presented to him in a form of a question. This is known as the hypothetical question. By means of it, the expert is asked to assume certain facts which witnesses had previously testified to and express an opinion based on those facts. It is important to note that the opinion must be based only on the facts included in the hypothetical question. Should the expert base his opinion upon any additional facts not covered in the hypothetical question, his opinion has no probative value and may be stricken from the record. It is not necessary that the facts assumed in the hypothetical question be proved by a preponderance of testimony. It is sufficient that witnesses have so testified.

In the case of German-American Insurance Company v. New York Gas and Electric Light and Heat and Power Company and another, decided in New York in 1905, it appears that a building in New York City was destroyed by fire. The plaintiff had issued fire insurance policies to tenants and after the fire had paid losses. Thus, it was subrogated to the rights of the tenants. The plaintiff sued the defendant on the ground that the destruction of the property covered by the policies was caused by negligence in the maintenance and construction of electric wires upon the building. The defendant North River Electric Light and Power Company, later succeeded by the defendant New York Edison Company, had installed electric wires for the purpose of furnishing lights to the tenants. The testimony was that wires rested on a metal

cornice; that insulation on the wires had rubbed away; that as a result, a short circuit was caused and that the metal cornice had melted and that the wood underneath had caught fire. The following hypothetical question was propounded to the expert witness and held by the court to be proper:

"Assuming that secondary wires, carrying 50 volts of electricity, are strung along and run over a tin or metallic cornice, which cornice is attached to the building, which secondary wires are attached on the front of the cornice on porcelain knobs and then extended, without any other insulation of porcelain knobs, over and along the top of the cornice of the building, state whether or not that is good construction."

To be an effective witness, the engineer must be able to analyze a technical problem for judge and jury in such manner that they may clearly understand it and agree with his contentions. The engineer should bear in mind that his testimony is to be taken before, and the issues decided by, persons who in all probability have no technical skill, experience or training. He must, therefore, be prepared, if called upon, to explain and give reasons for his opinions in terms which will be understandable to the layman, judge and jury. Any discussion or explanation in highly technical terms, no matter how learned and profound, will only serve to confuse and probably bore the persons upon whom rests the duty to decide the case. It is to be expected that a juror will discard that which he cannot understand.

The expert witness, because of his superior knowledge of the subject matter involved, sometimes yields to a natural impulse to expose the ignorance of the subject matter on the part of an opposing lawyer who may be cross examining him. The expert may also attempt to ridicule or poke fun at opposing counsel. Or in his anxiety to justify himself, the expert may argue with his opponent. Such conduct almost always acts as a boomerang to the expert and his side. The dignified and courteous bearing of an expert witness on the stand has never failed to impress favorably both judge and jury.

Above all, the expert must never give the impression of evading an issue. Every question must be met squarely. Many an expert witness has ruined the effectiveness of potent testimony by attempting to slide from under a question or by assuming the defensive and attempting an uncalled-for, long-winded justification of an answer. The witness must remember that if a question requires an answer that seemingly is damaging to his side unless explained, the opportunity for such explanation will surely arise when his own counsel resumes his examination.

Brevity is the soul of wit. It is also the soul of good testimony. Judges and juries don't like to be lectured. Answers should be short and to the point. Even when a discussion of a technical feature of the case is required, it should be made as brief as possible.

A word of caution must be added. The engineer, like the expert in other fields, in his enthusiasm and desire to aid in achieving victory for the side for which he is testifying sometimes is inclined to disregard scientific principles in order to render a more favorable opinion. It must be remembered that the value of an expert's testimony is in direct proportion to his reputed integrity. Courts quickly learn to identify the expert whose testimony may be accepted without question in contrast to the one who is willing to stretch a point to favor his side. Furthermore, the respect and regard of the public for any profession is seriously affected by the honesty of the members of that profession who are called upon to render opinions

in open court. For very often, the testimony of experts reaches the public eye through newsprint.

Honest men may sincerely differ in their opinions. But, unfortunately, occasions arise when the difference of opinion is promoted by a handsome fee. The cumulative effect of the rarely expressed dishonest opinions is far greater than that of the much more frequent honest opinion. For it is the dishonest ones which attract the greatest attention.

The writer believes that the engineer has been less blameworthy in this regard than the members of other professions. Continued scrupulousness will, no doubt, add to the reputed integrity of the engineering profession and the high regard in which it is justly held by the public.

Garbage Collection and Incineration Costs in Lakewood, Ohio

Through the kindness of E. A. Fisher, City Engineer of Lakewood, Ohio, we have been furnished with detailed breakdowns of costs of collection and disposal of garbage in that city. The average amount of garbage collected during the years 1932 to 1939, inclusive, amounts to 14,100.6 tons per year, ranging from a low of 11,676.1 tons in 1932 to 16,568.4 tons in 1939. In addition an average of 820.7 tons of other refuse were collected. The total cost of collection, exclusive of extraordinary equipment costs, amounted to $4.246 per ton, and including extraordinary costs above noted $4.404 per ton.

This collection cost was made up of the following items and amounts: Supervision, 12.55 cents per ton; labor, $3.829 per ton; fuel, light and supplies, 2.163 cents per ton; truck repairs and parts, 5.11 cents per ton; gasoline and oil, 15.48 cents per ton; garage rent, 6.14 cents per ton; and insurance and bonds, 0.24 cents per ton. These amounts aggregate $4.246 per ton, and cover the averages of the 8-year period. The 1939 figures were slightly lower, amounting to a total of $4.0412 per ton. The average load of garbage amounted to 2.54 tons, and in 1939 was 2.76 tons.

A total of 16,568.4 tons of mixed garbage and 1,155.1 tons of combustible refuse were burned in the incinerator in 1939. The number of burning hours was 4,135.5 and the average amount of refuse burned per hour was 4.3 tons; the per cent of ash was 9.2. During 1939, no coal was required in the operation of the incinerator; in fact, none has been used since 1936.

The cost of operating the incinerator is given for each month in 1939, for each year from 1932 to 1939, inclusive and a weighted 8-year average is also given. Furnace labor amounted to 48.96 cents per ton in 1939, as compared to the 8-year weighted average of 42.18 cents per ton. General labor costs were, on the same bases, 20.80 cents and 17.55 cents per ton. The total labor costs for operating were 62.64 cents and 59.73 cents per ton, respectively. Coal averaged 0.58 cent per ton over the 8 years, but none was used in 1939. Average electric costs per ton were 2.94 cents for 1939 and 4.29 cents for the 8-year weighted average. Supervision and weighmaster costs per ton were, respectively, 7.33 cents and 4.34 cents for 1939, and 15.57 cents and 2.58 cents for the 8-year average. Prior to 1936, the weighmaster was included in the labor costs. The total operation cost for 1939 amounted to 82.39 cents per ton; the 8-year weighted average of operating cost was 82.75 cents a ton. Maintenance labor amounted to 3.8 cents per ton in 1939, and 6.26 cents for the 8-year average.

The Sewerage Digest

A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Cost Records of Sludge Disposal

The value of cost records of sludge disposal would be greatly increased if those of all cities were calculated on a standard basis, especially of what costs to include. J. W. Kirkpatrick, Indiana State Board of Health, proposes the following: A—Fixed charges on all portions of the capitalization (structures, land, piping, pumps and other equipment), representing sludge control, handling and disposal facilities. Depreciation should be included. B—Maintenance charges on all of above facilities (materials and labor). C—Operation charges on all of above facilities (materials, labor, power and heat). Labor includes common labor, technical control and supervision. It is assumed that the equipment consists of piping, digesters, gas storage tanks, drying beds, incinerators and all other facilities which would not be present if the sludge mysteriously disappeared at the end of the sedimentation or digestion process.[C42]

Dallas, Tex., New Treatment Plant

Dallas put into operation April 16 a new plant for a population equivalent of 500,000; dry weather flow 20 mgd. Owing to high temperature of sewage (part of the water supply of the city has a temperature over 100°) and high mineral content, largely sodium sulfate, and large quantity of industrial wastes and storm water, the treatment problem was difficult. Activated sludge, chemical precipitation and trickling filters were considered and the last chosen because of overall cost of treatment and dependability of functioning and net results expected. The trickling filter will take shock loads and perform more consistently than either of the others.

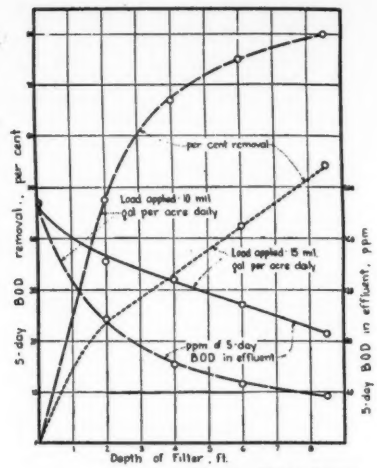
For odor prevention, the sewage after reaching the plant is completely confined in air-tight enclosures ventilated into a stack. For grease removal, air is blown into the sewage for 4 minutes, then chlorinated air for 4 minutes, and the grease thus floated is swept by flat water sprays to an area from which it is automatically removed at intervals controlled by a time clock. Flow of sewage to the old and new units is divided automatically in any desired proportion. Two trickling filters of 176 ft. diameter were designed on the basis of B.O.D. removal rather than volume of sewage. Sludge will be disposed of in lagoons, as has been done satisfactorily for 10 years with Imhoff sludge. Time clocks have been used freely, and motors wherever they would lighten the operator's burden; there are 77 motor-operated and 5 hydraulically operated units that enter into the daily routine operation.[G21]

Corrugated Lining For Old Brick Sewer

A 2-ring egg-shaped brick sewer in La Crosse, Wis., 50 years old, was badly cracked with roof settling. It was a main trunk line and could not be put out of service for repairs. These were made by threading into it corrugated pipe with asphalt invert, egg-shaped, 56″x19″; the old sewer being nominally 60″x20″. Lateral connections were made by metal collars cut into the liner. After each 100 ft. of liner was in place, the space between liner and old sewer was filled with concrete forced in by compressed air.[J16]

High-rate Trickling Filters

At the Baltimore, Md., plant, a small portion of the 30 acres of filters was used for experiments in high-rate filtration in 1938-39, from which it was concluded that ponding will not occur at any rate of flow from 6.5 to 30 mgad; the B.O.D. reduction decreases somewhat as the rate increases but was not marked at even 10 mgad, and at 26 mgad was 50% in winter and 70% in summer; at 10 mgad a considerable removal of B.O.D. can be obtained with filters only 2 to 4 ft. deep. If an effluent is desired better than that from sedimentation but inferior to that from a low-rate trickling filter, a high-rate filter may serve, giving treatment comparable to chemical precipitation or sedimentation and magnetite filters.[C48]



Character of effluent at various depths from high-rate trickling filters at Baltimore.

Metabolism of Glucose by Activated Sludge

In activated sludge treatment, the glucose removal reaction is considered to be the result of biological metabolism following adsorption and not simple adsorption upon the surfaces of the floc. The removal of glucose from solution by normal activated sludge and pure cultures of zoogleal bacteria is largely an oxidative assimilation reaction, in which the greater part of the glucose appears as protoplasm within the sludge in a few hours after the glucose has been fed.[C49]

Oil and Grease in Sewage

Grease and oil in sewage may cause explosions and fires and grease balls, blind screens at the plant, cause unsightly accumulations on walls, interfere with Imhoff tank functions and the activated sludge process, cause grease and scum formations and odors, clog filters, nozzles and sand beds, destroy paint and interefere with digestion processes. Grease may be removed partly as scum and partly as sludge, but removal at the source is much more effective. Mechanical skimmers are the most popular equipment used for the purpose; aeration of sewage previous to settling aids in bringing grease to the surface, porous plate diffusers being the most popular method of applying the air. Removing grease from trade wastes is effected by use of sulfuric or sulfurous or other acid. Skimmings are disposed of by

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burning, burial or digestion, or processed for grease recovery. In drying in lagoons, undigested skimmings are very odorous. Most plants digest them.[C52]

Carbon Dioxide in Biological Filter Beds

From experiments conducted with small tube filters it was concluded that carbonaceous matter is oxidized to CO_2 to a much greater extent in filter beds than in the activated sludge process. While an activated sludge process produces about 10% of total carbon input as CO_2 in the effluent air, these experimental filters produced 8.5% to 48.2%.[C53]

Copperas-Sodium Silicate As a Sewage Coagulant

Investigations at the Chicago West Side works revealed that a combination of copperas and sodium silicate gave striking efficient results at comparatively low cost. It gave 72% to 75% removal of BOD against 65.0% to 67.8% by ferric chloride with the same sewage. The floc formed was tough, readily separable and with greater adsorptive power than when other chemicals were used. It is believed that the silicon takes the form of a colloidal hydrous silicon dioxide having a strong negative charge, to which the hydroxides of iron adhere. Aeration by mechanical means was not essential to formation of the floc. With copperas delivered at $16 a ton, sodium silicate at $14 and 66° sulfuric acid at $16, the cost for chemicals ranged between $2.76 and $1.64 per million gallons of sewage; the cost for ferric chloride at the same time ranging between $4.10 and $2.28; but with the price of ferric chloride at $30 a ton the costs of the two methods would not differ greatly.

Copperas is recovered from spent steel pickling liquors, and experiments with these liquors themselves used with sodium silicate indicated that such was practicable and would probably be advantageous where the liquor is conveniently obtainable.[C54]

Revenue From Sewage Plant

Corpus Christi, Texas, sells its sediment-free effluent to a local oil refinery which will (when the refinery starts up again) bring a revenue of $100 a day. Its sludge is pulverized and bagged and, during ideal drying weather, has brought in more than $40 a week, which would be three times as great if the Park Dept. did not take most of it.[H27]

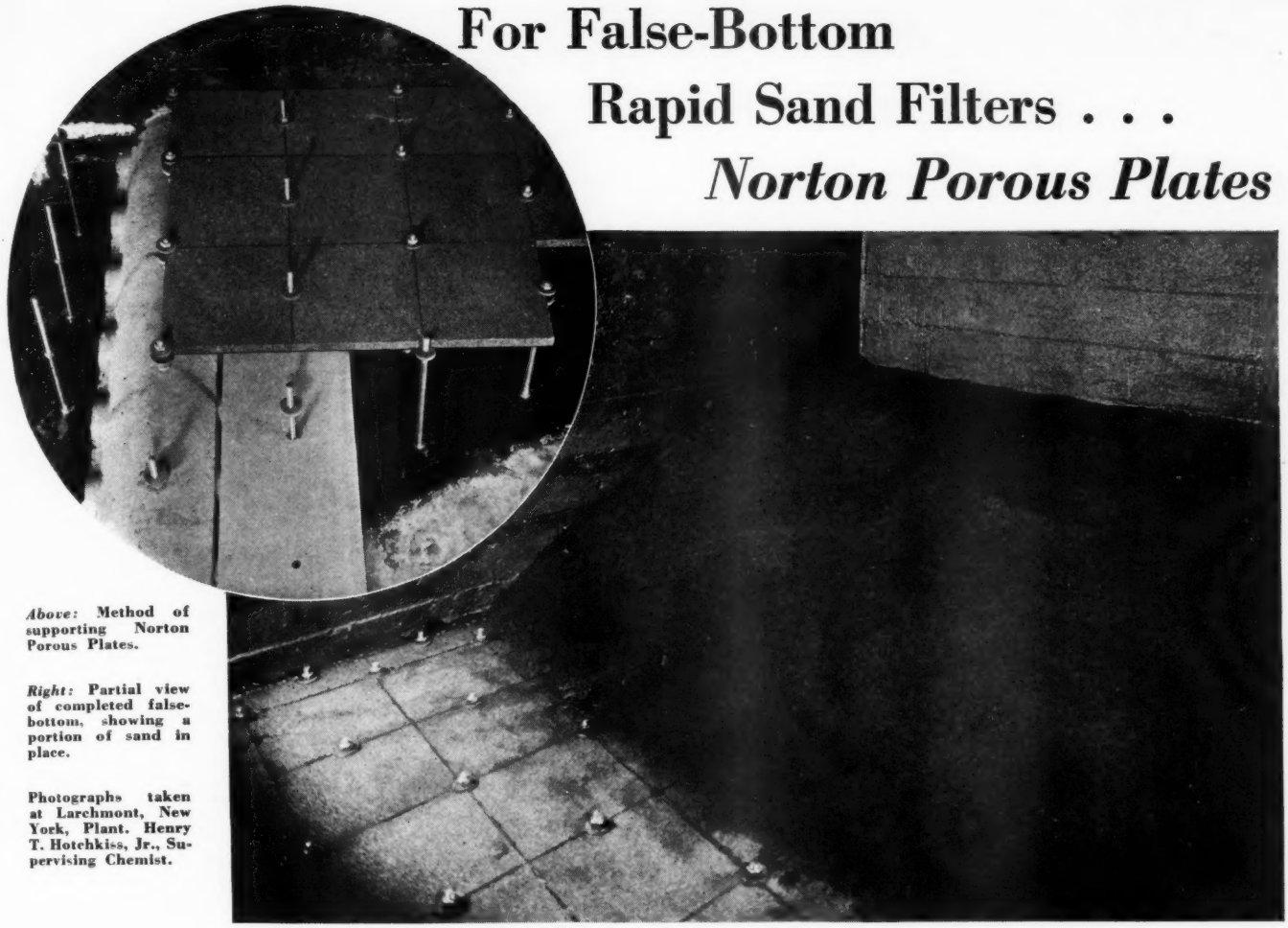
Chironomid Flies In Treatment Plants

The chironomid fly may cause a turbid effluent, clumpy masses of activated sludge collecting in the corners of tanks and poor settlement of sludge. Its eggs are laid in dark corners of aeration and settling tanks. The larvae live in the sludge, but live only if there is dissolved oxygen in the tank. They devour bacteria, protozoa and organic matter and may destroy all the activated sludge. The most effective control is by pyrethrum applied to the activated sludged mixed liquor, which paralyzes their nervous system. Connecticut plants have used doses of one pound of pyrethrum powder per 5,000 gal. of plant capacity—probably one-fourth this dose containing 0.9% pyrethrins and costing about 35c a pound would be sufficient.[H29]

Designing Plant For Present Capacity

In designing the new treatment plant for Dallas, Tex., the capacity was based on present rather than far future requirements because "(1) Hy-

For False-Bottom Rapid Sand Filters . . . *Norton Porous Plates*



Above: Method of supporting Norton Porous Plates.

Right: Partial view of completed false-bottom, showing a portion of sand in place.

Photographs taken at Larchmont, New York, Plant. Henry T. Hotchkiss, Jr., Supervising Chemist.

THE rapid sand filtration method of water treatment is an important problem of many municipal engineers.

The Camp process has introduced marked improvements in this system of filtration due to the use of Norton Porous Plates.

First, the inherent qualities of the plates make them peculiarly adaptable to this type of work. They are strong and uniform; and can be furnished in the desired structure.

Second, the patented Camp bottom is adaptable to old installations (see illustrations). This false-bottom design provides equal rates of flow of wash water through every square inch of bottom—an important factor in long life and efficient filter operation.

If you are operating rapid sand filters or contemplating their construction you'll want more information about Norton Porous Plates.

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draulic structures function most satisfactorily while operating under the optimum conditions of flow and it is our opinion that such can not be had when designs are projected far into the future and based on flows that are not attainable; (2) money invested in structures and equipment in excess of the present need is a costly procedure in terms of interest paid and should be held to the minimum; (3) equipment suffers depreciation and requires maintenance without giving back adequate returns; (4) treatment methods may be discovered or developed in the near future that will render present equipment obsolete. However, the design has been so laid out that additional units needed to increase the capacity can be provided."[G21]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
May

48. *t.* Experiments with High-Rate Trickling Filter at Baltimore. By C. E. Keefer and H. Kratz, Jr. Pp. 477-484.
49. *t.* Metabolism of Glucose by Activated Sludge. By C. C. Ruchhoft, J. F. Kachmar and O. R. Placak. Pp. 485-503.
50. *t.* Analysis of the Biochemical Oxygen Demand Curve. By H. A. Thomas, Jr. Pp. 504-512.
51. Observations on Sewage Sedimentation. By N. C. Wittwer. Pp. 513-526.
52. Oil and Grease in Sewage. By W. S. Mahlie. Pp. 527-556.
53. *t.* Production of Carbon Dioxide in the Biological Filter Bed. By H. Wilson and J. A. McLachlan. Pp. 557-561.
54. *t.* Use of Copperas-Sodium Silicate as a Sewage Coagulant. By E. Hurwitz and F. M. Williamson. Pp. 562-570.
55. Regulation of Stream Pollution in the Raritan River Basin by the New Jersey State Dept. of Health. By L. Forman and R. P. Johns. Pp. 571-585.
56. Buffalo River Stream Pollution Studies. By G. E. Symons and W. L. Torrey. Pp. 586-600.
57. *t.* Some Effects of Sulfur Dye Waste Upon Sludge Digestion. By R. Porges, H. J. Miles and H. G. Baity. Pp. 601-612.
58. Certification of Sewage Plant Operators. By C. T. Mudgett. Pp. 613, 618.
59. Report on Operation and Maintenance of Division of Sewage Disposal of Cleveland, O., for 1939. By J. W. Ellms. Pp. 625-628.

D *The Surveyor*
June 7

19. *p.* Rectangular Tank: Efficiency and Adaptation to Desludging Mechanism. By H. D. Thatcher. Pp. 493-494.

E *Engineering News-Record*
June 6

19. Vacuum Cleaner for Septic Tanks. By A. J. Lazenby. Pp. 71-72.

G *Water Works & Sewerage*
June

21. The New Sewage Treatment Plant of Dallas, Tex. By R. M. Dixon. Pp. 245-255.

H *Municipal Sanitation*
June

27. Plant Effluent Sold to Oil Refinery. By S. L. Allison. Pp. 279-281.
28. *p.* Stream Pollution Control Advances in Indiana. By B. A. Poole. Pp. 282-284.
29. The Chironomid Fly. By L. W. Van Kleeck. Pp. 285-287.

J *American City*
June

14. Refuse Handling Diversified in Cambridge, Mass. Pp. 66-67.
15. Sewage Sludge Treatment: Centrifuge and Sub-decanting. Pp. 69-70.
16. Old Brick Sewer Relined in La Crosse, Wis. By J. H. Barth. Pp. 73-74.

L *Civil Engineering*
June

3. Pollution Abatement in New York Area. By C. J. Velz. Pp. 349-352.

M *Canadian Engineer*
May

3. Sewage Disposal at Recent Large Plants. By A. L. Falls. Pp. 7-15, 55.
4. *p.* The Biofiltration Process of Sewage Treatment. By A. J. Fischer and R. B. Thompson. Pp. 16, 38-41, 51, 52.

P *Public Works*
June

30. Collection and Disposal of Garbage and Refuse in American Cities. Pp. 9-11, 31-34.
31. Flocculation, Chemical Treatment and Flexible Filters. By W. E. Buell. P. 18.
32. The Use of Sludge as Fertilizer and Soil Conditioner. By L. W. Van Kleeck. Pp. 20-22.
33. *p.* Electric Motors and Controls for Sewage Treatment Plants. By J. O. Kammerman. Pp. 36-37.

Recovery for Engineering Services

The Illinois Appellate Court held, Consoer, Townsend & Quinlan v. Calumet City, 18 N. E. 2d 81, that a corporation could recover from a city the value of engineering services performed by plaintiffs as engineers in connection with a special assessment proceeding for construction of a sewer where the improvement had been abandoned by the city before levying the assessment.

Head house of Sacramento, Calif., water supply.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Brilliant Green Bile for Bacteriological Examinations

Comparative studies of brilliant green bile and lactose broth in examination of water at Cambridge, Mass., have proved that the former may be used satisfactorily with raw water samples as a direct inoculum. It is slightly inhibitive for coagulated, filtered and chlorinated waters. As a confirmatory medium it shows a high degree of correlaton with the results obtained with eosine-methylene-blue plates and subsequent tests.[B7]

Softening Water For Southern California

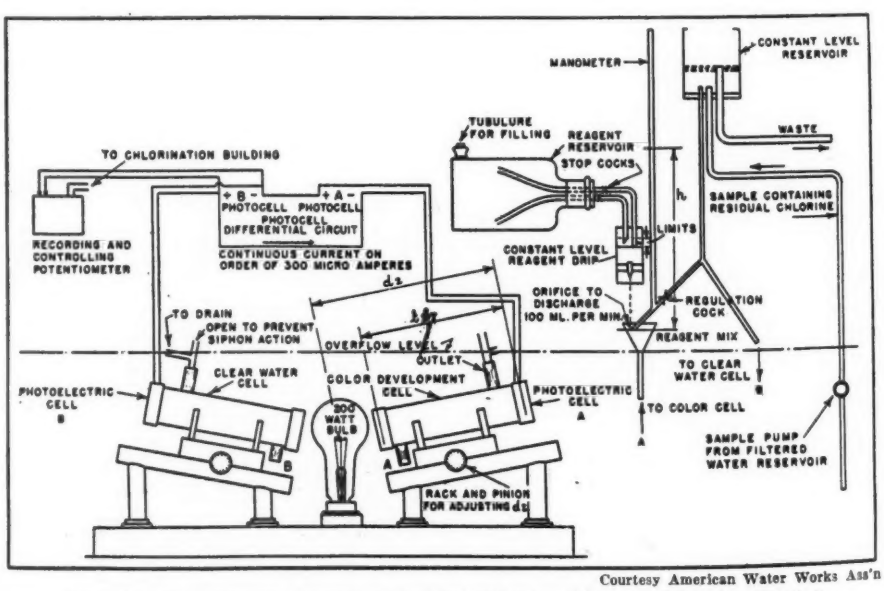
A plant for softening the water to be supplied to Southern California from the Colorado river is under construction 30 miles east of Los Angeles. Present capacity 100 mgd; ultimate capacity 400 mgd. The water has a carbonate hardness of 145, non-carbonate 160. The lime-zeolite process was chosen as most suitable for this water; lime to precipitate calcium carbonate only (not magnesium, therefore lime can be reclaimed from the sludge at low cost), after which and filtration and pH adjustment, enough water is softened to zero through zeolite to reduce the hardness of the combined effluent to the desired point. This process gives a lower cost for chemicals than either the lime-soda ash or the zeolite—$7.46 per million gallons. Synthetic gel zeolite will be used because it permits smaller softening units, less waste water and less salt, and will have a long life with this water if the pH is adjusted.[G23]

Fractionated Coagulation In Argentina

Buenos Aires, Argentina, obtains its water supply from the River Plata, which is at times turbid and highly colored. Most of the turbidity settles readily, but retention of a moderate amount results in better coagulation flocs. According to experiments made, it is possible to enlarge the range of the optimum pH, reduce the dose and shorten the sedimentation time, either by fractionating the coagulant dose or by dispersion, or both. Fractionated coagulation is defined as consisting of "adding the total dose of coagulant in two fractions, leaving a time interval between doses, and employing either aluminum salts alone, or using them for the first fraction and iron salts for the second one." For this water it was found that mixing the coagulant for 10 sec. gave better results than for 5 sec. or 15 sec. The most effective time interval between adding the two doses lay between 90 and 120 sec. The coagulated water was then flocculated, 15 min. of flocculation giving much better results than 5 min. It was found that with fractionated coagulation, the dose of coagulant can be 16.7% less than without it and equal results obtained. Where iron salts were used for the second dose, the best results were obtained when half as much of these as of alum was used.[A92]

Photo-Cell Control Of Water Chlorination

Montreal, Canada, after filtering the supply taken in varying proportions from the St. Lawrence and Ottawa rivers, finds its chlorine demand to vary between 1.0 and 0.1 ppm, and the chemist of the plant desired a dependable method of automatically regulating the chlorine dose to this varying demand. The Redeal-Evans Chlorometer which depends upon the electro-chemical action of a platinum copper couple in the presence of free chlorine, was found unsuitable. He experimented with different types of photo-sensitive cells, and finally devised a photo-electric equipment that controls and records the residual chlorine, maintaining a residual of about 0.05 ppm after a 10 min. absorption period. A small pump draws a con-



Courtesy American Water Works Ass'n

Assembly for Automatic Control of Residual Chlorine (Montreal Filtration Works)

With the hot summer weather well on the way, waterworks men must be on the lookout for tastes and odors in water supplies.

All that is necessary for algae to grow is water and light. However, they do thrive more profusely under warm temperature conditions so that every plant operator should be alert for the first signs of tastes and odors from this source. Warm weather also facilitates the decomposition of organic matter in water supplies and there is always associated with this decomposition an objectionable taste and odor which must be corrected.

At this time of year rainfall is usually not plentiful and from now on through the summer low stream flows and low water supplies can be anticipated. These low water supplies can result in tastes and odors from industrial wastes, decomposing sludge, silt, etc.

AQUA NUCHAR Activated Carbon has been demonstrated conclusively to be the most effective means of eliminating tastes and odors from water supplies. Check your stocks now and make sure that you have an adequate supply of AQUA NUCHAR on hand to take care of tastes and odors which are on their way.

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tinuous sample of the treated water and discharges it through 250 ft. of ½" copper pipe to a constant-level orifice box, from which two streams flow to water cells, into one of which orthotolidin or other reagent is added continuously at a uniform rate, giving it a color intensity strictly proportional to the amount of residual chlorine. The two cells are diametrically opposite each other in the path of a common light source. The two beams of light, after passing through the two water cells, are intercepted by two photo-electric cells of the barrier-layer type connected in a differential circuit which is balanced electrically when there is clear water in both cells. The electrical balance is upset by an amount proportional to the amount of color in the cell receiving the water to which the reagent has been applied, and this causes motion in the pen of a standard recording and controlling potentiometer, and an opening or closing of the chlorine valve at 10 min. intervals.[A98]

Storage Reservoir Aids Water Treatment

Ashland, Ky., has completed a reservoir with a capacity of more than 20 mg, or ten days' supply. The Ohio river water used for the city's supply is heavily polluted, the B. Coli content reaching a monthly average of 65,000 per 100 cc sample and wide ranges of turbidity. The reservoir permits sedimentation and also tends to equalize the quality for filtering; permits discontinuing the taking of water from the river during a few days of high pollution, and provides for repairs to the plant that pumps water to it from the river. It is lined with concrete poured in hexagonal-shaped slabs 10 ft. on a side, the joints between which are of hot expansion joint compound. The slabs are reinforced except where on bed rock.[E27]

Depreciation of Cast Iron Mains

Cast iron mains have, on the average, substantially longer lives in service than has hitherto been considered to be the case. An average life of 50 years or more may be expected for 4" pipe, materially over 100 years for 6", and 150 years or more for larger sizes. These life expectancies should be revised upward in those plants where conditions of service and growth are relatively satisfactory and stable, but downwards in certain cases where local conditions indicate shorter life.

The straight-line method of accounting for depreciation has no basis of fact or reason for use other than simplicity; particularly as it affects accounting for depreciation in long-lived property such as water mains, it is arbitrary, destructive of value, exorbitant in its demands upon the early rate payers, and bears no relationship to the way in which water mains are retired or depreciate in value.

The compound-interest method, using an interest rate approximating the rate of return, appears to fulfill the purpose of relating a method of computation for determining depreciation in cast iron mains to the way retirements may be expected, with sufficient reserve to allow for a considerable variation from the basic data used and yet having a substantial provision for accrued depreciation in units of property remaining in service. Correctly applied, it is little more difficult to apply than those based upon straight-line or other arbitrary assumptions, but the results of its application are so much more equitable to all concerned, particularly in long-lived elements of property, that, even if slightly more difficult to apply, its use is warranted where depreciation is to be determined by computation.

The reserves built up and currently being built up by the straight-line and

certain other methods have become and are becoming excessive, and the continued use of these methods will result in the management of water works properties becoming primarily problems of investment, with materially less time available to the personnel for problems of effective operation.[A94]

Lining Mains In Position

Lining pipes with cement mortar in Charleston, S. C., began in 1922, but not until 1939 was it possible to so line mains already laid. This was done in the fall of that year by the Tate process. W. T. Tate, an Australian, patented the process in Australia in 1932. In 1938 an American company obtained a license for the United States, and in 1939 contracted to clean and line 2½ miles of 4", 6" and 8" mains in Charleston. After lining, a *C* of 128 based on nominal diameter was obtained, and carrying capacities were increased 210% to 280% over those of the uncleaned pipe. The total cost on unpaved streets with few services averaged 45 cts. per foot for 4" pipe, 46 cts. for 6" and 50 cts. for 8", including temporary service connections.

The procedure includes cutting out of service the section to be lined, usually 300 to 400 ft., laying a temporary 2" line on the surface to supply connected services, pulling through the main special scrapers strong enough to cut off protruding lead at joints or corporation stops, followed by steel brushes and squeegees run through several times, thus removing all loose material and water, and then a metal proving plug. Sufficient stiff mortar to more than line the entire section is placed in one end of it and pushed through it by means of a bullet-shaped device drawn through by cable and held in true center by springs, filling with mortar the annular space between it and the pipe, the conical part of the device containing openings through which laittance squeezed out of the lining can enter, followed by a smooth surface for troweling the lining. About 100 ft. an hour can be lined, but the preparatory work requires much more time. The lining is commonly made ⅛" to ¼" thick. Great care is taken to use the best sand and cement, mixed to just the consistency found best for this work. The resulting lining has a continuous surface throughout the length, unbroken at joints and therefore eliminating leakage.[A95]

Sterlizing New Mains

At Springfield, Ill., sterilizing new mains was defeated by jute in the joints; also leather seats on fire hydrants were found to be contaminated and after a 3-hour treatment with ordinary chlorine solution still contaminated the water. At present, the jute is cut to length for use, loosened up and suspended in a solution of lime water, then dried, placed in boxes and covered with lime. The boxes are taken to the job and jute transferred directly from box to joint, the men wearing gloves in handling it. The mains are filled with water in which 100 to 1000 ppm of lime has been dissolved. The lime solution is easier to handle than chlorine.[A84]

Testing Motor-Driven Pumps

In municipal pumping stations, centrifugal or turbine pumps are invariably directly connected to electric motors, without speed reduction. Guarantees are usually given on the basis of discharge at a given delivery pressure; also of efficiency, sometimes as overall wire-to-water efficiency, or on the motor and pump separately. The motors are usually of the induction type, with speed varying slightly with the output, but sometimes synchronous motors of fixed speed. Test data necessary are volume of water discharged, suction and discharge pressures, speed of unit, electrical input and losses.

Volume measures are usually made by venturi meter. It is more reliable to measure the differential across the tube

(Continued on page 58)

directly rather than by dial readings, using a mercury differential gauge, or preferably directly in feet of water.

Suction and discharge pressures are measured by two water columns, or mercury columns if this is impracticable, or by pressure gauges carefully calibrated before and after the test. The suction and discharge pipes where pressures are taken should be of equal diameter if possible; if not, allowance must be made for differences in velocity head. Four piezometer openings should be made 90° apart and joined by a ring to which the gauge or mercury column is attached.

Electrical measurements are sometimes taken from switchboard instruments, but it is preferable to use a set of portable instruments, including voltage and current transformers, ammeters, voltmeter and a polyphase wattmeter.[A96 & 97]

In any pump test, the choice of the gages and the methods of measuring the flow are principally a matter of convenience and opportunity. The key to a successful pump test lies in the care taken to eliminate all possible source of error. It is impossible to list all the factors that may affect the accuracy of the test. The efficiency as calculated can be no more accurate than are the coefficients used in the flow formulas.[A97]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Ass'n*

May

90. Water and Government. By P. V. McNutt. Pp. 719-728.
91. Changes in Patent Laws. By A. C. Brown. Pp. 729-741.
92. Fractionated Coagulation: A New Procedure. By R. A. Trelles, D. J. Bengolea and A. G. Poccard. Pp. 742-750.
93. Water Supply System of San Francisco. By N. A. Eckart. Pp. 751-794.
94. Depreciation of Cast Iron Water Mains Related to Actual Service Lives. By R. Newsom and E. H. Aldrich. Pp. 795-818.
95. Lining Cast Iron Mains in Position With Cement Mortar. By J. E. Gibson. Pp. 819-837.
96. Testing Motor-Driven Pumps. By R. W. Angus. Pp. 838-844.
97. Methods of Testing Pumping Equipment. By C. J. Des Baillets. Pp. 845-858.
98. Photo-Cell Control of Water Chlorination. By J. H. Harrington. Pp. 859-870.

E *Engineering News-Record*

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25. A Quarter Century of (Los Angeles) Aqueduct Maintenance. Pp. 54-57.
26. *c.* Access to the Delaware Aqueduct. Pp. 67-70.

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27. Water Storage at Ashland, Ky., Aids Treatment of River Supply. By J. P. Brownstead. P. 69.

F *Water Works Engineering*

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54. Water Practices of Atlanta, Ga. By N. N. Wolpert. Pp. 740-746.
55. Pumping Station Modernization at Montclair, N. J. By S. K. Knox. Pp. 747-748, 772.
56. Maintenance of Gate Valves. Pp. 775-776.

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57. Old Spanish Aqueducts Replaced in Guatemala City. By R. Hancock. Pp. 806-807.
58. Batavia Changes from Direct Pumping to Elevated Storage. By H. M. Cook. P. 819.
59. Installing Distribution Valves. Pp. 820-821.

G *Water Works & Sewerage*

June

22. War Measures for Protecting Britain's Water and Sewerage Services. By J. S. Trevor. Pp. 236-239.
23. The Softening Plant of the Metropolitan Water District of Southern California. By C. P. Hoover, J. M. Montgomery and W. W. Aultman. Pp. 261-265.
24. A Year's Experience With the Palmer Filter Sweep. By E. C. Goehring. Pp. 282-285.

J *American City*

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17. Reducing Magnesium Hardness at Fergus Falls, Minn. By J. E. Young. Pp. 54-55, 74.
18. Metering and Accounting. By M. S. Dutton. Pp. 58-59.
19. Water Rates and Service Charges. Pp. 89, 91, 93, 95.

L *Civil Engineering*

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9. Combined Water Tower and Municipal Building. By W. D. Darby. Pp. 329-332.

P *Public Works*

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21. The Faribault, Minn., Pumping Station. Pp. 14-16.
22. *n.* Amount of Domestic Consumption of Water. P. 16.
23. Leaks and Water Waste. P. 22.
24. Modern Filter Plant Treats 100 G.P.M. P. 24.

T *Technique Sanitaire*

March-April

5. L'Epuration des Eaux Usees a Athus (Belgique) par le Procede Henry. Pp. 19-20.

W *Johnson National Drillers Journal*

May-June

3. Ground Water—Its Development, Uses and Conservation. Pp. 1-7.

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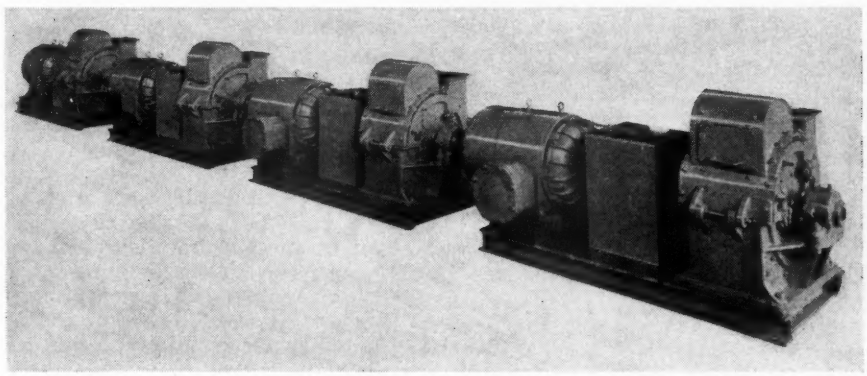
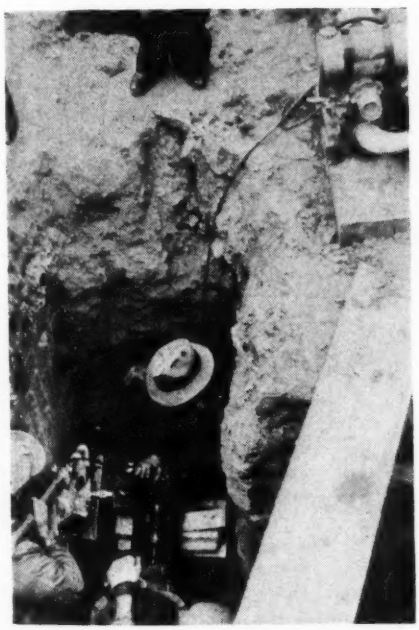


Gruendler screenings grinders for Coney Island



Homelite Generator and Bardwell Wrench operating tapping machine.

Power Wrench Driven by ¾" Electric Drill

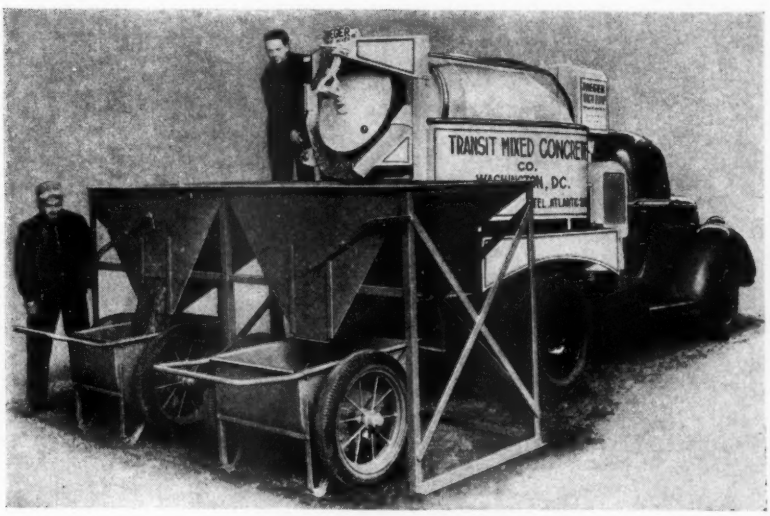
A convenient portable power wrench, suitable for opening and closing large gate valves or for driving wet tapping machines in water works operation, or for power operation of hand winches and hoists, is being sold by the Homelite Corporation, Port Chester, New York. This Bardwell Wrench is a simple unit for reducing the speed and increasing the torque of the ¾" electric drill used as the power source.

The electric drill may be attached to the wrench frame in a few minutes and likewise may be removed in a few minutes for use on other types of work. Any make of electric drill such as Skilsaw, Black and Decker, Mall may be used, as the wrench frame is adjustable to take drills of different makes. A portable Homelite Generator is used to supply the electricity. The value of this equipment in saving time and labor in tapping cast iron water mains was recently demonstrated in North Kansas City, Mo. An 8-inch tap had to be made in an extra heavy 10-inch C.I. main. An A. P. Smith Tapping Machine was used and the cutter was driven by the Bardwell Wrench instead of by the commonly used hand ratchet. The cut was made in less than half the time that would have been required by hand.

On another recent tapping job the Schenectady, N. Y., Water Department using a 12-inch A. P. Smith Cutter, a Homelite 1250-watt Generator and a Bardwell Wrench, made a 12-inch cut in a 24-inch Class C cast iron main in two hours and 45 minutes. The operation was done with one man. Similar cuts previously made by this same department by hand had required eight men working in turns for a total of twelve to sixteen hours. In addition to the time saving they also report a saving of about eight feet of excavation because of the fact that the Bardwell Wrench could be operated in a more restricted space than the hand ratchet.

Jaeger "High Dump" Truck Mixer and Agitator

"Further and higher" is the simple purpose behind the development of the Jaeger line of "High Dump" truck mixers and agitators. Designed with a high discharge point to meet unusual placing conditions, it will deliver concrete, low slump or high, over a wider radius, will spout it into higher forms, over material piles, into large floor hoppers.

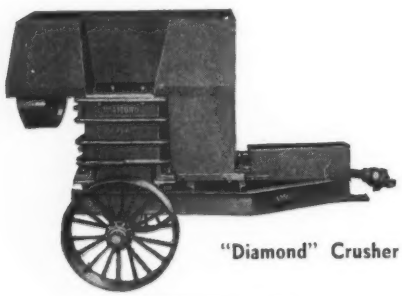


Jaeger "High-Dump" truck mixer

Many advanced features distinguish this line, among which are the following:

Extra big drums, top loading in one drop to provide extra capacity, all that the truck is designed to carry. Dual-mix action to insure higher strength concrete because of the positive, thorough mixing. Vacuum operated discharge door, requiring but a touch to open or close. Sypho-meter tank with "winter-safety" water booster to measure water accurately within ½ of 1%, unaffected by splashing or surging of water in tank. Advanced design, cab-controlled truck engine drive. Two-speed, shock-proof transmission.

Another important advantage of Jaeger "high dump" mixers is their compactness which permits mounting 2 yd. size on short wheelbase trucks such as the 134" wheelbase Ford. Also available in 3 and 4-yd. mixer size.



"Diamond" Crusher

Tractor Powered Portable Crusher

A portable crusher for road and street construction, and the maintenance field, has been developed by the Diamond Iron Works, Inc., Minneapolis, Minn. It is designed for fast portability to break down rock or gravel excavated during grading so that the crushed material can be rolled right back into roadbed instead of roadside stacking or trucking away. It will travel into any roadside pit where the tractor can go.

The crusher is powered from the rear power take-off of any tractor through a flexible joint drive shaft and V belts, and will operate for crushing scattered stones while the tractor is traveling.

These units are made in several crusher sizes to meet operating conditions, and all moving parts are enclosed for safety to workmen.

New Carryall Scraper by LeTourneau

R. G. LeTourneau Inc., Peoria, Ill., has introduced a single bucket Carryall Scraper—the Model LS—rated at 8.2 cubic yards struck capacity and 11 cubic yards heaped. Loading is made easy by a longer and steeper blade base, which causes material to boil in, to flow back into the bowl and forward into the apron. Additional yards are made possible by higher sides and a built up apron which retains full loads and prevents spilling. A newly designed "A" frame gives more room for bigger loads, speeds up loading, facilitates dumping of sticky materials, and also adds structural strength.

Technical Society Meetings

North Carolina Sewage Works Assn. and North Carolina Section AWWA will hold a joint meeting at Raleigh, N. C., Oct. 28-30. Headquarters will be at the Hotel Sir Walter. Space for exhibits will be provided. Roy L. Williams is chairman of the local arrangements committee.

New England Sewage Works Association will hold its fall meeting at Springfield, Mass., Oct. 16 and 17, with headquarters at the Hotel Kimball. L. W. Van Kleeck, State Board of Health, Hartford, Conn., is secretary-treasurer.

Water and Sewage Works Manufacturers Association

The Water Works Manufacturers Association has adopted a new constitution and the new name given above, a letter ballot favoring this by 111 of the 143 members voting. There are four classes of membership under the new constitution: Class A—those engaged in both water works and sewage works activities. Class W—those engaged in water works activities. Class S—those engaged in sewage works activities. Class B—a limited sectional membership.

There are two divisions, a water works manufacturers division and a sewage works manufacturers, for each of which there will be an Executive Committee of 9 members, responsible to the Board of Governors. The water works phases of the reorganization are to be presented during the New England Water Works Convention, Sept. 24-27, and those of the sewage works division during the convention of the Federation of Sewage Works Associations, Oct. 3-5. Steps to put the new Constitution and By-laws into effective operation are in charge of a special committee of which Wm. J. Orchard is Chairman.

W. A. Hardenbergh, Vice-Pres. PUBLIC WORKS, addressing Penn. Water Works Operators Assn. on "The Value to the Small Company of Recent Developments in Water Works Practice."

LeTourneau Model LS Carryall Scraper

PERSONAL NEWS

The following county engineers have been appointed:

J. R. Horton, Ben Hill County, Fitzgerald, Ga.

Herbert F. Larson, Iron County, Crystal Falls, Mich.

Frank Bartunek, Leelanau County, Suttons Bay, Mich.

A. L. Harris, Lubbock County, Lubbock, Tex.

The following new appointments as city managers have been reported:

Percy Bloxam, Roxboro, N. C.

The following new appointments as city engineers have been reported:

Clyde E. Williams, South Bend, Ind.

Robert J. Torrens, Laurel, Mont.

The following new appointments for water works superintendents have been reported:

Giles Cain, South Bend, Ind.

Cornelius P. Driscoll, Haverhill, Mass.

Harry Eaton, Shrewsbury, Mass.

Leland Carlton, Springfield, Mass.

Correction: In our May issue, we reported erroneously that H. T. Hargrave had been appointed city manager of Gainesville, Fla. Actually Mr. J. B. Mobley, Jr. was appointed city manager Oct. 18, 1937, and is still serving in that capacity. He was elected president of the Florida State City Managers Association on April 21, 1940.